FOREST PEST CONDITIONS IN WISCONSIN

ANNUAL REPORT 1993

DEPARTMENT OF NATURAL RESOURCES
BOX 7921
MADISON, WISCONSIN 53707

FOREST PEST CONDITIONS IN WISCONSIN ANNUAL REPORT - 1993

Compiled and Edited by Allen J. Prey,
David J. Hall, and Jane Cummings Carlson

DEPARTMENT OF NATURAL RESOURCES
Division of Resource Management
Bureau of Forestry

ACKNOWLEDGEMENTS

This record of the activities of forest pests and other destructive agents of growing trees in Wisconsin's forest nurseries, plantations, and natural timber areas was made possible by the dedicated work of pest management personnel in each district and at the Forest Pest Management Laboratory in Madison. Department of Natural Resources foresters, other Department field personnel, cooperators in other public agencies and private forest industry contributed valuable assistance in monitoring the forest lands in all classes of forest ownership.

Preparation of this Annual Report was a result of a team effort involving Andrea Diss, William Kearby, Todd Lanigan, and Shane Weber, DNR District Pest Specialists who submitted district reports. Jane Cummings Carlson and Dave Hall, Forest Pest Unit, Madison, consolidated the district reports and wrote the final draft. Final printing was done by the DNR Bureau of Program Services.

Allen J. Frey
Supervisor, Forest Pest Management

TABLE OF CONTENTS

PAGE NO.

Forest Pest Management Personnel v

INTRODUCTION vi

ASH 1
- Ash Decline 1
- Ash Flowergall Mite 1

ASPEN 2
- Forest Tent Caterpillar 2

BALSAM FIR 4
- Spruce Budworm 4
- Balsam Gall Midge 4
- Balsam Twig Aphid 4

BASSWOOD 4
- Introduced Basswood Thrips 4

BIRCH 5
- White Birch Dieback 5
- Birch Leafminer 5

BLACK WALNUT 5
- Butternut Wollyworm 5

BUTTERNUT 6
- Butternut Canker 6

CHERRY 7
- Eastern Tent Caterpillar 7
- A Lacebug 7

CHESTNUT 7
- Chestnut Blight 7

CHRISTMAS TREES 8
Balsam Gall Midge 8
Balsam Twig Aphid 8
Spruce Needle Rust 8
Cytospora Canker 8

LARCH 9
Larch Top Dieback and Mortality 9
Larch Needlecast 9

MAPLE 10
Sugar Maple Decline Survey 10
Red Maple Dieback and Mortality 11
Saddled Prominent 11

MISCELLANEOUS 12
Anthracnose 12
Frost 12
Road Salt Injury 12
Chainspotted Geometer 12
Gypsy Moth 12
Hickory Bark Beetle 15
Mountain-ash Sawfly 15
Wood Tick 16

NURSERY 17
White Pine Seedling Root Rot 17
Diplodia Shoot Blight and Canker 17
Oak Seedling Mortality 18

OAK 19
Oak Wilt 19
Two-lined Chestnut Borer 22
Redhumped Oakworm 22
Post Oak Locust 22

PINE 23
Common Pine Shoot Beetle 23
Diplodia Canker and Shoot Blight 23
Red Pine Shoot Blight 24
White Pine Blister Rust 24
Pine Tussock Moth 25
Jack Pine Budworm 25
European Pine Sawfly 44
Red Pine Sawfly 44
Jack Pine Sawfly 44
Introduced Pine Sawfly 44
Eastern Pine Shoot Borer 45
Saratoga Spittlebug 45
Pine Spittlebug 45
White Pine Aphid 45
White Pine Weevil 45
Pine Engraver 45
Meadow Vole 45
Flooding 47

SPRUCE 48
Yellowheaded Spruce Sawfly 48

YEW 48
American Yew 48

APPENDIX A 49

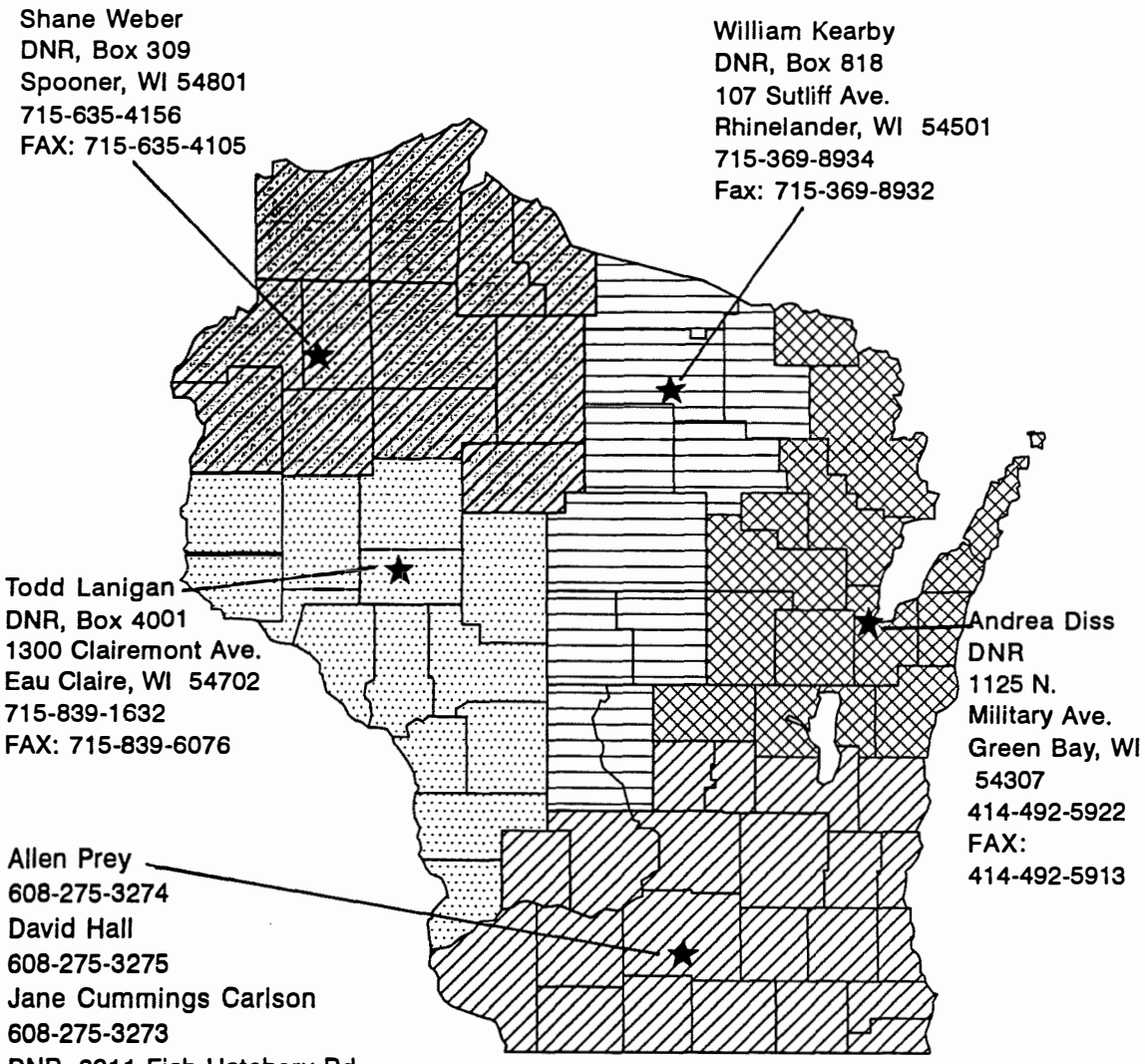

Figure 1. Station locations of Wisconsin Department of Natural Resources District Entomologists and Forest Pest Unit Personnel.

DEPARTMENT OF NATURAL RESOURCES
Forest Pest Management Personnel - December 31, 1993

Name	Title	Address	Telephone
Prey, Allen J.	Supervisor, Forest Pest Management	DNR, 3911 Fish Hatchery Road, Madison, WI 53711	(608) 275-3274
Hall, David J.	Forest Entomologist	DNR, 3911 Fish Hatchery Road, Madison, WI 53711	(608) 275-3275
Cummings Carlson, Jane E.	Forest Pathologist	DNR, 3911 Fish Hatchery Road, Madison, WI 53711	(608) 275-3273

****

Kearby, William H.	Forest Entomologist	DNR, NCD Headquarters 107 Sutliff Avenue P.O. Box 818 Rhinelander, WI 54501-0818	(715) 369-8934
Lanigan, Todd	Forest Entomologist	DNR, WD Headquarters 1300 W. Clairemont Ave. P.O. Box 4001 Eau Claire, WI 54702-4001	(715) 839-1632
Weber, Shane D.	Forest Entomologist	DNR, NWD Headquarters Hwy. 70 West P.O. Box 309 Spooner, WI 54801-0309	(715) 635-4156
Diss, Andrea	Forest Entomologist	DNR, LMD Headquarters 1125 N. Military Avenue P.O. Box 10448 Green Bay, WI 54307-0448	(414) 492-5922

INTRODUCTION

This report lists the major insect, disease and other health problems reported on forest land in Wisconsin in 1993. While the report does not list all the insect and disease problems that occurred on forest land, it does highlight major or noteworthy insect infestations and disease occurrences including abiotic damage to trees.

In 1993, insect and disease detection surveys were conducted on 8.1 million acres and evaluation surveys on 4.6 million acres. In addition, Wisconsin DNR district pest specialists continued to teach integrated pest management principles to Wisconsin DNR foresters, industrial foresters, and private woodland owners. District forest pest specialists and forest pest unit staff provided a wide variety of programs and information on forest pests in 1993.

The following activities were accomplished by the district pest specialists and the forest pest unit staff in the Bureau of Forestry.

OUTREACH

Presentations on IPM practices and updates on specific pest problems were given to the following groups and meetings: Wisconsin Woodland Owners Association, Menominee Forestry Council; landowners in Marinette County; the Marinette County Forestry Committee; Lake Michigan District park superintendents; school children in Marinette; students at the University of Wisconsin - Green Bay, Stevens Point and Madison; forestry staff at Cumberland; school children in Spooner; Spooner Kiwanis club; Ernie Swift youth camp participants; USDA Forest Service public information meeting in Drummond; DNR District forestry meetings; Burnett County meeting; Forest Productivity Council; Forest Pest Council; Woodruff and Antigo Area forestry meetings; Georgia-Pacific landowners in Wood and Adams counties; Consolidated Paper Corporation; "Friends of the Park" at Roche-A-Cri State Park; County Forest Administrators; Eau Claire County Parks and Forestry; Winnebago Tribal Meeting; Oak wilt workshop for arborists and foresters, western District; Monroe County tree farm meeting; Acid rain council; Landowners in Milwaukee; school children in Oregon; and the Walnut Council.

Numerous radio interviews and press releases were conducted on topics including gypsy moth biology, trapping and management; oak wilt biology and management; the status of butternut; ticks; jack pine budworm; black flies and mosquitoes.

Presentations were made at the following professional meetings: Society of American Foresters statewide meeting; Biological Control Conference; Stewardship Conference; American Phytopathological Society Annual Meeting; Audubon Society; North Central Forest Pest Workshop; Pine Barrens Symposium; Jack Pine Budworm Workshop; Urban Forestry Conference; Wisconsin Arborists Association statewide meeting; and the Tri-State forestry meeting.

The forest pest management exhibit showcasing the gypsy moth, butternut canker, oak wilt and other pests was displayed at meetings of the following associations: Wisconsin Woodland Owners; Society of American Foresters; Wisconsin Christmas tree growers; and various DNR District and Area meetings.

TRAINING

Sixteen Wisconsin forestry personnel attended a training session on oak silviculture in Roscommon, Michigan. Michigan DNR and CES co-hosted the training session. Several defoliated stands were visited to learn the effects of habitat type on gypsy moth defoliation and resulting tree mortality. The training session was part of a project to develop silvicultural guidelines for oak stands threatened by gypsy moth.

New foresters were given training on herbicides and planting techniques. The forest inventory and analysis crews were trained in the new pest coding system for the lake states. Foresters and the general public were trained on various topics including: white pine pests; jack pine budworm; karner blue butterfly; forest tent caterpillar; oak wilt; two-lined chestnut borer; pest management and stewardship plans; and butternut canker and silviculture.

Some or all of the forest pest specialists and forest pest staff attended numerous training sessions including: Incidence Command System I-220; chainsaw safety; forest vegetation management; leadworker training; Society of American Forester's field tour; walnut council tour; Karner blue butterfly tour; DNR VAX/Mail and other computer training courses; hearing conservation; leadership; Androc pesticide update; biodiversity training conference; and tree decay principles.

MEETINGS

Some or all of the forest pest specialists and forest pest staff attended the following meetings: USDA Forest Service state cooperators meeting; North Central Forest Pest Workshop; National Gypsy Moth meeting; American Phytopathological Society Annual meeting; Society of American Foresters Statewide meeting; Midcontinental Nursery Pathologists meeting; Forest Health Monitoring Planning Sessions; Wisconsin Christmas Tree Growers meeting; Eastern U.S. Nursery Conference; Forest Survey Standardization meetings; Logging conference; Ontario Forest Insect and Disease meeting; and the International Union of Forestry Research Organizations (IUFRO) meeting on diseases and insects in forest nurseries held in Dijon, France.

REPORTS AND PAPERS

The following reports were completed: Accomplishment report; Forest Health report; and the Annual Report of Forest Pest Conditions. A paper titled "Incidence and Severity of Butternut Canker in Wisconsin in 1976 and 1992" was presented at the American Phytopathological Society meeting. (An abstract by the same title was published in the journal Plant Disease.) A paper titled "Biology and Control of *Sphaeropsis sapinea* in Nurseries and Plantations of Wisconsin, USA" was presented at the IUFRO meeting on diseases and insects in forest nurseries. Guidelines were developed for surveying and preventing damage to endangered Karner Blue butterfly populations in budworm-damaged jack pine stands. Developed silvicultural guidelines on oak stands threatened by the gypsy moth in the Lake States. Published a University of Wisconsin-Extension bulletin titled "Oak Wilt in the Lake States: What are the Options". Published a paper in the Northern Journal of Applied Forestry titled "Survey of Black Walnut Plantations in Five Central States".

ANNUAL REPORT - 1993

ASH

Ash Decline - Unknown

Northwest Wisconsin witnessed widespread dieback and decline of black ash in swamps following drought and severe frost damage. Stands in swampy areas that dried out during the 1987-89 drought exhibited some scattered tree mortality in 1993. Stands that suffered nearly total defoliation during the June 20, 1992 frost exhibited scattered top dieback in individual trees.

Ash Flowergall Mite - *Aceria fraxiniflora*

Reported in Chippewa, Clark, Eau Claire and St. Croix counties; only yard trees were effected.

ASPEN

Forest Tent Caterpillar - *Malacosoma disstria* (Hubner)

The outbreak in northeastern Wisconsin continues to decline in size. A total of 52,000 acres were heavily defoliated, all in Marinette County (Figure 2). Spotty, light defoliation occurred over a much larger area in Marinette, Forest and Oconto counties and was concentrated in stands of aspen.

Overwintering egg mass surveys done at eight sites across Marinette County indicate the outbreak has collapsed. No more than two egg masses were found at any one site.

Two thousand acres were sprayed twice with B.t. in May, 1993, as part of a community-organized foliage protection program. The area sprayed was on the west side of the Menominee River, north of Marinette, along and east of State Highway 180 in Marinette County. The area is residential with many overmature northern pin oaks that had been completely defoliated for at least two years in a row. Community organizers circulated a waiver form to allow spraying of property and also collected $75.00 from each landowner. Foliage protection was good and most participants felt the effort was worthwhile. It should be noted that the number of egg masses at this site was high enough to result in complete defoliation, and that areas bordering on the spray block had significant defoliation.

An egg mass survey conducted in January and February, 1993 indicates population levels will be high in 1993 in southeastern Marinette County and northern Oconto County. All sites sampled in Peshtigo, Porterfield, and Lake townships in Marinette County and Brazeau Township in Oconto County had large numbers of egg masses, and viability of the eggs was 95 percent or better. Heavy defoliation should be expected on aspen and oak in these areas.

In Marinette County some owners of wooded residential lots are organizing an aerial spray project to protect their shade trees. They are receiving technical help from the DNR forest entomologist.

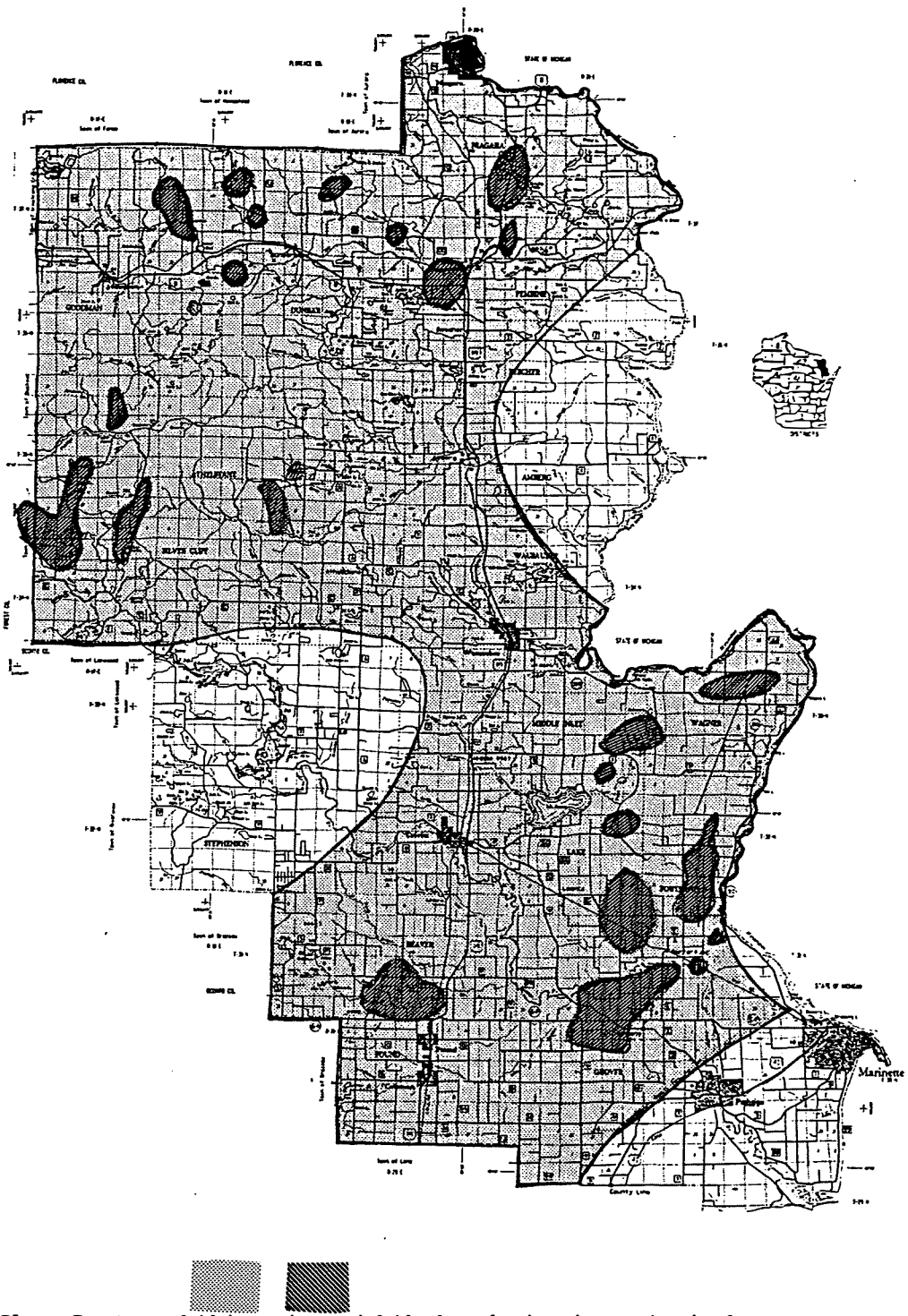

Figure 2. Area of light to heavy defoliation of oak and aspen by the forest tent caterpillar-1993.

BALSAM FIR

Spruce Budworm - *Choristoneura fumiferana* (Clemens)

Populations erupted in Langlade and Oneida counties where moderate to heavy defoliation of plantation-grown balsam fir and natural and plantation-grown white spruce occurred. Natural stands of white spruce were heavily defoliated in Three Lakes township, Oneida County (T38N, R11W, Section 6). Plantation-grown white spruce was heavily defoliated in Three Lakes township (T38N, R10E, Section 6) and in Sugar Camp township (T39N, R10E, Section 31) where a 40-year-old thinned stand was defoliated. An abandoned 40-year-old Christmas tree plantation of white spruce and balsam fir was heavily defoliated in Vilas township of Langlade County (T32N, R9E, Section 12).

Balsam Gall Midge - *Paradiplosis tumifex* (Gagne)

Adults were active in Chippewa County on May 5.

Balsam Twig Aphid - *Mindarus abietinus* Koch

First hatch was noted in Marathon County May 12.

BASSWOOD

Introduced Basswood Thrips - *Thrips calcaratus* Uzel

Moderate to heavy defoliation of basswood was spotty on approximately 15,000 acres in Rusk County, northwestern Wisconsin (Wilson and Murry townships). Defoliation of basswood was also reported in LaCrosse, Dunn, and Menominee counties. Moderate to heavy defoliation was spotty in eastern and south-central Forest County and in northeastern Oneida County.

BIRCH

White Birch Dieback and Mortality: Drought

The heavy mortality since the 1987-89 drought in the northern counties has stabilized. While the present birch volume is greatly reduced from former levels, it appears reasonably healthy. In the north-central counties, 83 percent of the tree crowns were in the 0 to 5 percent decline category.

Birch Leafminer - *Fenusa pusilla* (Lepeletier)

It was an average year for this spring leaf miner. Locally heavy defoliation of ornamental and road-side white birch occurred in the northwestern counties. Scattered reports of damage to yard trees were received from throughout western Wisconsin.

BLACK WALNUT

Butternut Wollyworm - *Eriocampa juglandis* (Fitch)

A very small population of this sawfly continues to infest a sapling black walnut plantation in Grant County.

A small population was found feeding on butternut in Door County.

BUTTERNUT

Butternut Canker - *Sirrococcus clavigignenti - juglandacearum* Nair, Kostichka and Kuntz

No new county locations were reported in 1993 (Figure 3). Efforts on this disease are being concentrated on development of silvicultural guidelines. A management alert was issued in 1993 instituting a restriction on cutting healthy, noncankered butternut, 10-inch DBH or larger on DNR State lands. Selected trees will be used for collection of scion wood for propagation of butternut resistant to the canker.

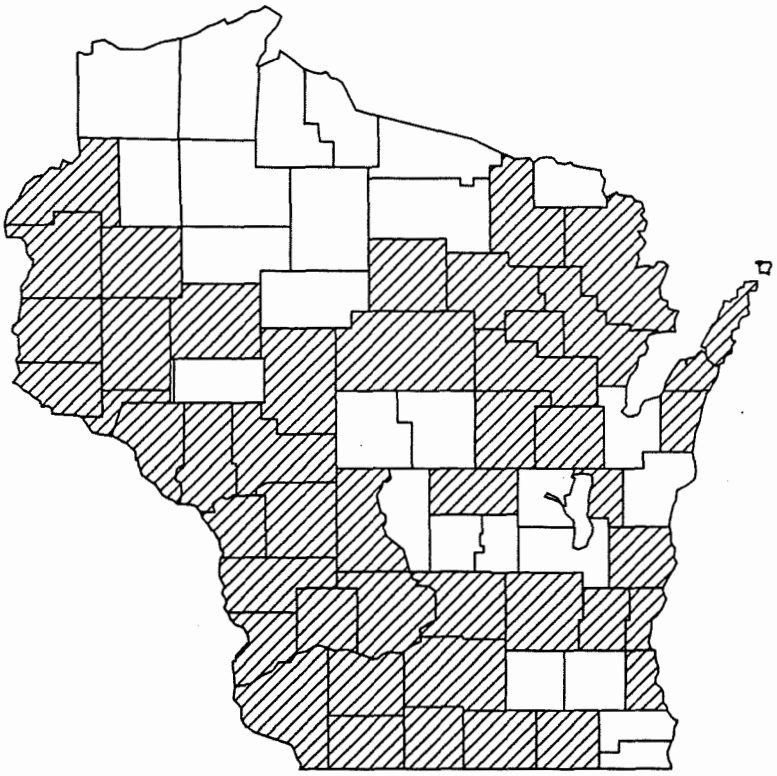

Figure 3. Known county distribution of butternut canker - 1993.

CHERRY

Eastern Tent Caterpillar - *Malacosoma americanum* (Fabricius)

Numbers of tents were light in Chippewa and Clark counties as well as the northwestern counties.

Phenological Note:

May 19: Tents 2 inches in diameter in Chippewa and Clark counties.

A Lacebug - *Corythucha* sp.

A light population of a sap sucking lace bug was observed on black cherry leaves in Eau Claire County.

Unidentified microlepidoptera

An unidentified species of microlepidoptera damaged black cherry foliage in several woodlots in western Dane county. The larvae bore into the leaf petiole causing the leaf to die. The damage was distributed toward the tops of individual trees. Most trees were 50 percent defoliated and reflushed.

AMERICAN CHESTNUT

Chestnut Blight - *Cryphonectria parasitica* (Murr.) Barr

Survey and disease management efforts were concentrated on a 60-acre American chestnut stand in LaCrosse County where chestnut blight was first observed in 1987. This stand has approximately 2,500 American chestnuts >2 inches in diameter. In 1993, 118 cankers on 31 trees were monitored. Fifty-six cankers received their first treatment of hypovirulence (isolate of *C. parasitica* with a double stranded RNA (dsRNA) virus) in 1993 and 21 cankers received their second treatment. Callus formation was frequently observed on cankers treated in 1992. In 1994, the property will be resurveyed and new cankers will be treated with hypovirulence. Sampling for the presence of the dsRNA will be conducted from new and previously treated cankers.

CHRISTMAS TREES

Balsam Gall Midge - *Paradiplosis tumifex* (Gagne)

Injury to balsam fir Christmas trees was moderate in Chippewa, Langlade and Oneida counties. Some trees were withheld from market because of the damage.

Balsam Twig Aphid - *Mindarus abietinus* (Koch)

Damage to new needles was heavy on the lower third of tree crowns in Langlade, Marinette, Marathon and Oneida counties. Some producers sprayed their trees with chlorpyrifos. In a few plantations, the damage was too advanced to correct the damage during the current growing season.

Spruce Needle Rust - *Chrysomyxa* sp.

Pockets of heavy infection occurred on blue spruce in Washburn and Sawyer counties.

Cytospora Canker - *Cytospora chrysosperma*

Injury to balsam fir Christmas trees was moderate in Chippewa County.

LARCH

Larch Top Dieback and Mortality - Unknown

A survey was conducted in 2 plantations of Japanese and Japanese/European hybrid larch on the Coulee Experimental Forest, LaCrosse County, western Wisconsin (T16N, R5W, Section 19) for top dieback and mortality. In 1992, these plantations exhibited dieback and mortality, chlorosis, and pitchy cankers or splits in the bark. A fungus,*Botryosphaeria sp.* was isolated from the cankers. In 1993, affected trees were either dead or partially dead (usually the tree top was dead). Some trees had dead branches clustered around the pitchy cankers. There was no chlorosis of foliage and there did not appear to be any new bark cankers or fresh pitch. The cracks in the bark were fairly dried up and not producing pitch. These observations support the hypothesis that a one-time event such as the occurrence of spring and late spring frost injured the trees.

All of the trees in the two plantations were surveyed for the presence of dead branches and dead tops. The results are as follows:

SURVEY OF HYBRID AND JAPANESE LARCH PLANTATIONS
ON THE COULEE EXPERIMENTAL FOREST - JUNE 28, 1993.

PLANTATION	HEALTHY (NO. TREES)	DEAD BRANCHES (NO. TREES)	DEAD TOP (NO. TREES)	DEAD (NO. TREES)
Hybrid Larch	583	1	24	13
Japanese Larch	488	18	40	61

Larch Needlecast - *Mycosphaerella laricina* (Hartig) Neg.

This disease was severe on a 10-acre planting of European larch in Lorain Township (Section 32, T37N, R15W), Polk County. Severe defoliation occurred on 80 percent or more of the trees.

MAPLE

Sugar Maple Decline Survey - North American Maple Decline Project

Wisconsin continued to participate in the North American Maple Project, administered by the U.S. Forest Service and Canadian Forestry Service. Eighteen plots, each plot a cluster of 5, 20 x 20 meter plots, were established in Wisconsin in 1988, 9 in stands being tapped for maple syrup and 9 in forest stands not tapped for maple syrup (Figure 4). Each year, data on tree vigor, dieback, discoloration, dwarfing, and crown transparency have been collected. A five year summary report for the whole program is expected to be printed by July 1, 1994.

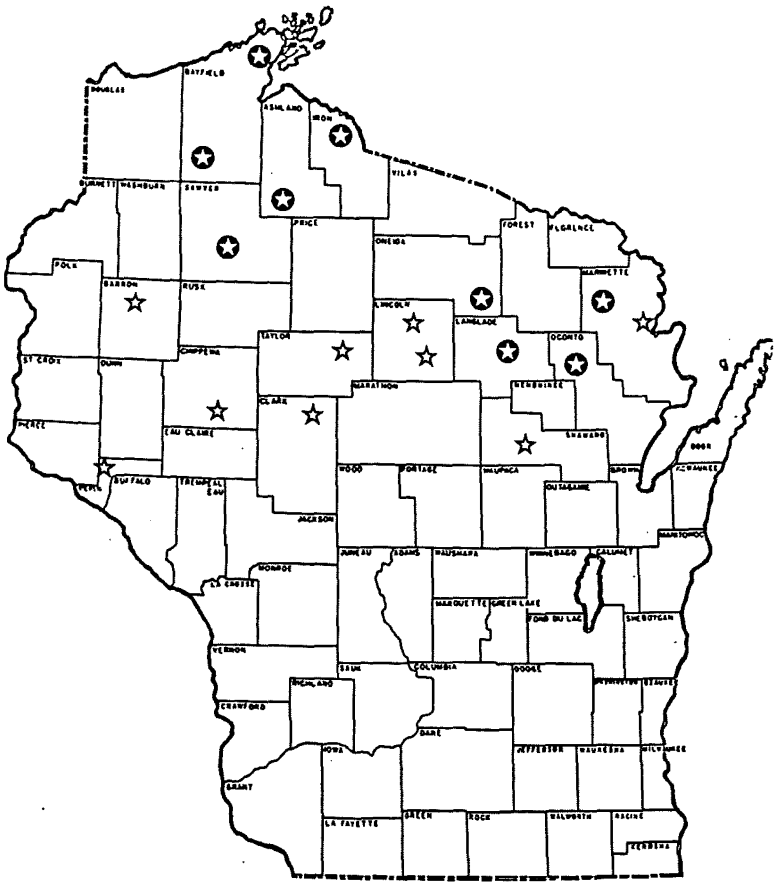

Figure 4. Location of plots in North American Sugar Maple Decline Project.

Undisturbed forest = ✪ Sugarbush = ☆

Red Maple Dieback and Mortality - Drought, fluctuating water table

Dieback and mortality of red maple was observed in Calumet County. This normally wet site was subjected to drought in 1988 and '89. In 1988, precipitation in this area in May and June was 1.9 and 2.0 inches below normal. The lack of moisture during this critical time for hardwoods probably stressed the trees throughout the growing season. The annual precipitation was 3.1 inches below normal in east-central Wisconsin in 1988. In 1989, June was again 2.3 inches below normal and the annual precipitation was 6.69 inches below normal. These 2 years of below normal precipitation, especially during the spring when new leaves are expanding, may have stressed the trees to the point of initiating top dieback.

Saddled Prominent - *Heterocampa guttivitta* (Walker)

The outbreak that had defoliated maples and oaks in 1991 and 1992 in Peninsula Park, Door County, collapsed this year.

MISCELLANEOUS

Anthracnose - A variety of fungi

Anthracnose was observed on white oak in Brown, Kewaunee, and Manitowoc counties and on ash along the shore of Green Bay in Marinette and Oconto counties and on oak, maple and ash throughout western Wisconsin. Severe wilting of leaves occurred on open-grown white oaks near Wausau in Marathon County. Wilting was extremely heavy on white oak in Washburn and Burnett counties.

Frost

A late spring frost caused shoot injury and growth loss in red pine plantations in the northwestern counties.

Road Salt Injury

Red and white pine along highways and roads throughout western Wisconsin showed signs of salt injury and winter burn.

Chainspotted Geometer - *Cingilia catenaria* (Drury)

A rare infestation of this polyphagous defoliator was observed on a 2-acre wetland in Chippewa County (T31N, R7W, Section 10). A heavy, late summer population completely defoliated the ground cover of labrador tea. White birch, tamarack, white pine and red maple along the edges of the wetland were also defoliated.

Gypsy Moth - *Lymantria dispar* (L.)

The State of Wisconsin used the Incident Command System (ICS) to organize the activities of two state and two federal agencies to conduct all the gypsy moth treatment and surveillance activities in 1993. Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade & Consumer Protection; the U.S. Forest Service; and the U.S.D.A. Animal & Plant Health Inspection Service cooperated under a "unified command" structure.

Seventeen sites in 8 counties, totaling 35,270 acres were sprayed twice with one gallon per acre of *Bacillus thuringiensis* (B.t.). Four of the sites in Dane and Jefferson counties were treated with an additional application. Nine sites totaling 1,357 acres were treated with mass trapping with 9 delta traps per acre, using a total of 12,213 traps. Over 27,200 additional traps were placed for detection, delimitation and to monitor the effectiveness of the B.t. applications. Egg mass surveys were conducted in areas that produced high trap catches (Figure 5).

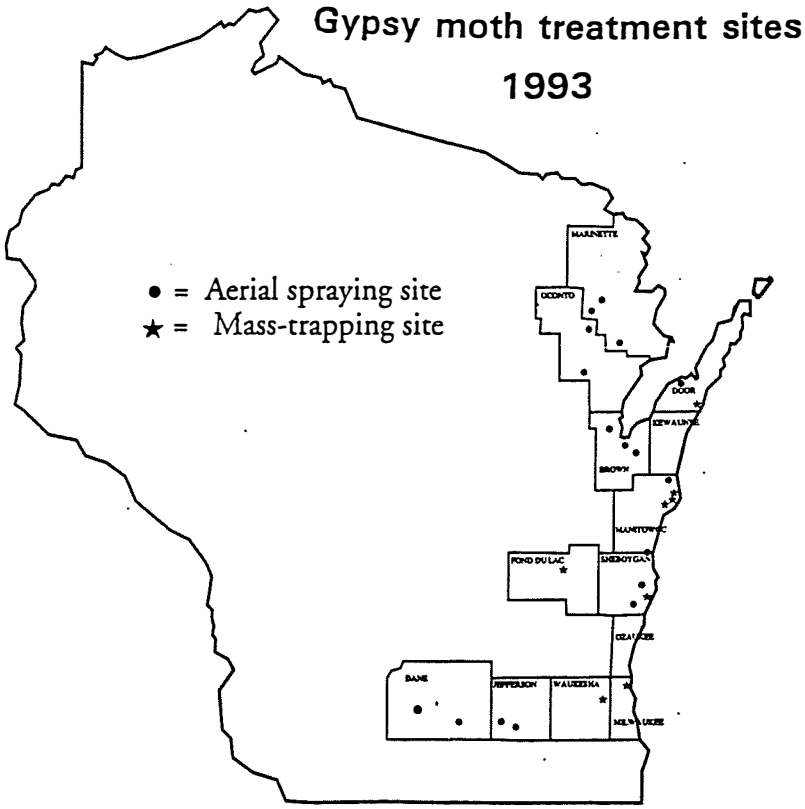

Figure 5. Gypsy moth treatment sites-1993.

The trapping results were clouded by a large blow-in of adult male moths from Michigan into the Lake Michigan shoreline areas of Wisconsin and the Upper Peninsula of Michigan. The blow-ins were detected before the resident populations could have produced adults in the cool climate along the lake shore; it appears to have occurred from Door County to Ozaukee County. The timing of the trap catches from along the lake shore can be used to separate local moths from blow-ins with some success. However, data from other areas does not provide a clear separation.

The egg mass surveys revealed several concentrations of over 100 egg masses in Marinette, Brown and Manitowoc counties.

Spraying reduced the populations. Trap catches in the spray areas were greatly reduced below 1992 levels in most of the treated areas and were zero in most of the southern sites.

A total of 9 new infestations have been found: two in Winnebago County, three in Rock and one each in Brown, Waukesha, Kewaunee and Jefferson counties.

Preliminary results of the mass trapping program are generally positive; however, the results in the areas along the lakeshore were somewhat clouded by the blow-in. Over 50 egg masses were found in the mass trap areas in 1992; only 1 was found in 1993. The density of traps, nine traps per acre, allows a finely focused egg mass survey that detects a high percentage of the egg masses. The removal of these egg masses appears to be an important part of the overall treatment effect.

The current plan for 1994 calls for spraying an estimated 54,375 acres with B.t.on 23 sites in 9 counties and mass trapping 7 sites totalling 198 acres.

MALE GYPSY MOTH TRAP CATCHES AS OF NOVEMBER 12, 1993.

COUNTY	MOTHS
Ashland	5
Brown	2,253
Calumet	106
Columbia	3
Dane	66
Door	8,386
Douglas	1
Florence	12
Fond du Lac	132
Forest	2
Green Lake	11
Jefferson	26
Kenosha	164
Kewaunee	3,436
Langlade	1
Manitowoc	9,178
Marathon	7
Marinette	2,792

COUNTY	MOTHS
Menominee	4
Milwaukee	1,307
Oconto	1,003
Outagamie	128
Ozaukee	1,518
Portage	4
Racine	228
Rock	183
Sauk	4
Shawano	4
Sheboygan	4,651
Walworth	17
Washington	239
Waukesha	38
Waupaca	12
Winnebago	133
Wood	5
TOTAL	36,326

Hickory Bark Beetle - *Scolytus quadrispinosus* (Say)

Scattered reports of beetle killed hickories were received from southern and western Wisconsin.

Mountain-ash Sawfly - *Pristiphora geniculata* (Hartig)

Instances of heavy defoliation of ornamental mountain ash were reported in Eau Claire County.

Wood Tick - *Dermacenter variabilis* sp.

High populations occurred in grass and brushy areas in Lincoln, Oneida and Vilas counties from May to August. People working or walking through these sites often encountered numerous ticks on their clothing.

NURSERY

White Pine Seedling Root Rot - *Fusarium* sp.

The USDA Forest Service continued to study the factors affecting this disease of white pine seedlings. The following report was submitted by Jennifer Juzwick, USDA Forest Service Research Plant Pathologist.

A preliminary investigation of compacted soil layers ("hard-pans") was carried out in two white pine fields at two nurseries. Evidence of a layer at 4 to 5 inches was found in different parts of both fields (a "tiller-pan") and one at approximately 12 inches in one of the fields ("plow-pan"). Compacted soil layers cause impeded drainage which results in higher soil moisture over longer periods of time compared to unaffected soils. Higher soil moisture have been associated with higher root disease in white pine fields in previously conducted field studies. Growth chamber experiments were conducted using loamy sand soil amended with pathogenic isolates of *Fusarium oxysporum, F. oxysporum* 'redolans', *F. solani,* and *F. proliferatum* or with sterile inoculum. Approximately 12 weeks after germination, white pine seedlings in each soil treatment were subjected to three different soil moisture conditions (saturated, field capacity, and dry) over 40 days. Preliminary results show higher frequency and severity of primary root lesions in *F. solani* and *F. oxysporum* 'redolans' soils subjected to either moisture extreme compared to the other treatments and the control. The effect of cover cropping with sudan grass on the build-up of *Fusarium* species in soil and on the severity of white pine root rot is being studies in two state nurseries. These studies were initiated in 1992 and 1993. Greenhouse and growth chamber testing began using potential biological control microorganisms as well as mycorrhizal fungi for their ability to suppress root rot in white pine.

Diplodia Shoot Blight and Canker - *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

See Appendix A for special report.

Diplodia shoot blight has been a pest of red pine seedlings at the Wilson state nursery in Boscobel, southwestern Wisconsin, since the early 1980's. An integrated pest management program including removal of infested windbreaks to reduce disease inoculum and a decrease in the use of Benomyl fungicide sprays was initiated in 1990. Disease incidence data from 1990, '91 and '92 showed promising results when disease incidence was low in unsprayed areas of the nursery. Yet in 1993, the incidence of this disease appeared to increase. Consistent rainfall throughout the growing season coupled with wind created perfect conditions for spores of *Sphaeropsis* to move around the nursery.

Oak Seedling Mortality - Unknown

Small pockets of dying red oak in their second growing season were reported from a private nursery in western Wisconsin and from the Hayward state nursery. Mycelial fans and sclerotia were observed under the bark in the root collar region. Often, the root collar area was rotted yet the roots and tops showed no signs of rot. Isolations from the affected seedlings by the DNR forest pathologist and a USDA Forest Service Pathologist were unsuccessful as the fungus would not fruit in culture. Since the injury appeared to originate at the root collar, cold injury was suspected as the primary cause of injury as temperatures dropped below 30°F on June 20, 1992. Symptoms were limited to seedlings in small pockets. Affected seedlings were probably at an earlier stage of growth and more susceptible to cold injury than unaffected seedlings. Unaffected seedlings were observed within only a few inches of the injured seedlings. Affected seedlings were removed from the beds and no further evidence of this problem appeared during the growing season.

OAK

Oak Wilt - *Ceratocystis fagacearum* (Bretz) Hunt

Oak wilt was not observed in any previously unreported counties (Figure 6) yet new pockets were observed in north-central and northeast Wisconsin. An aerial survey was conducted of Marinette, northwest Oconto, central Shawano (Figures 7-9) southeast Menominee, Chippewa, Eau Claire, and western Jackson counties. New infections centers were observed near Wausaukee and Niagra as well as to the west of High Falls reservoir in Marinette County. Several new infection centers were observed in Menominee County where an intensive survey and management program continues. Two new pockets were observed in Marathon County, one in Kronenwetter township and one in Mosinee township.

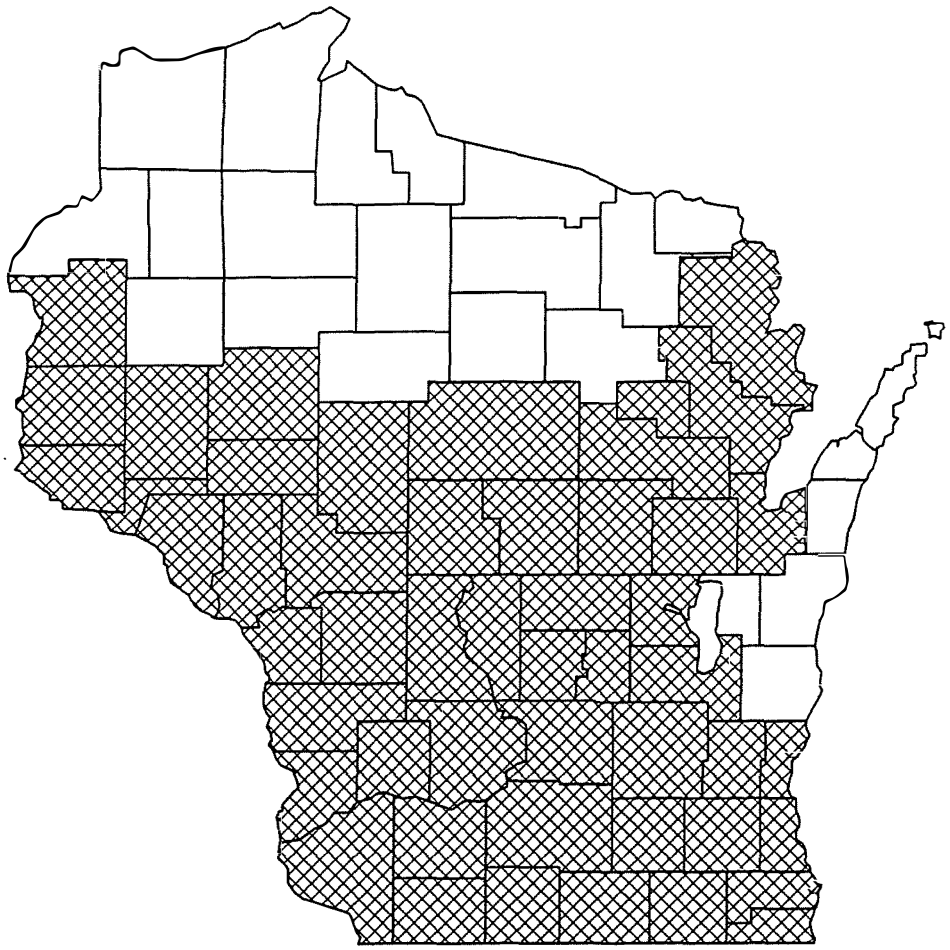

Figure 6. County location of Oak Wilt - 1993.

Oak mortality was reported from Sauk County, southern Wisconsin, surrounding the Sauk County landfill (T12N, R5E, Sections 14, 15). An aerial and ground survey revealed 19 pockets of dead and dying oak. Oak wilt and signs of the two-lined chestnut borer were observed throughout the pockets.

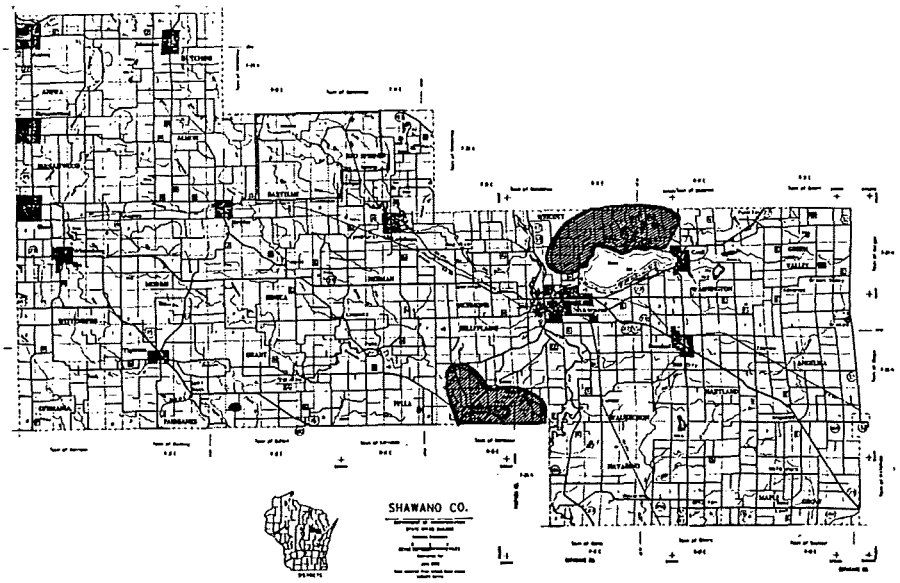

Figure 7. Area of Shawano County with oak wilt-1993.

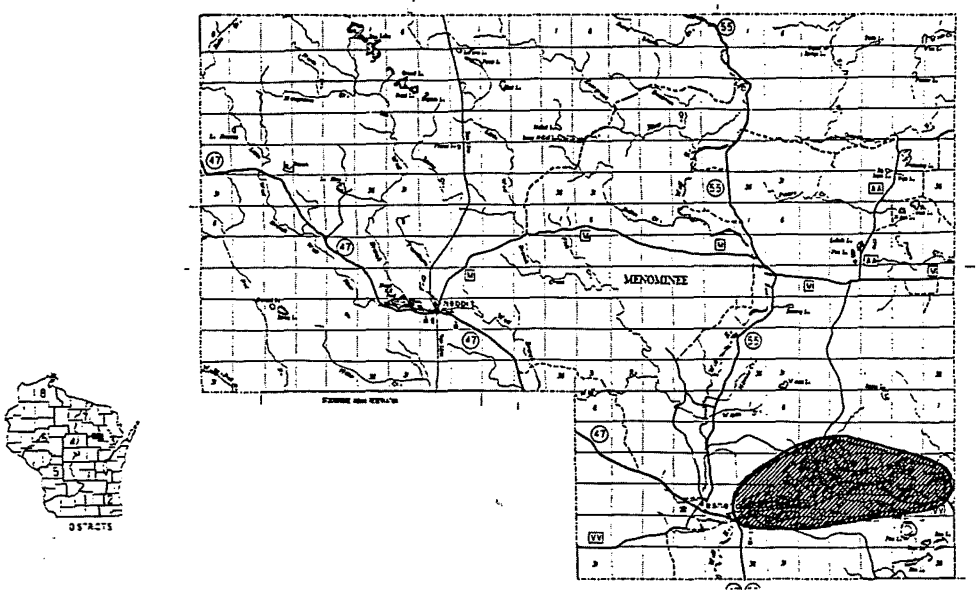

Figure 8. Area of Menominee County with oak wilt-1993.

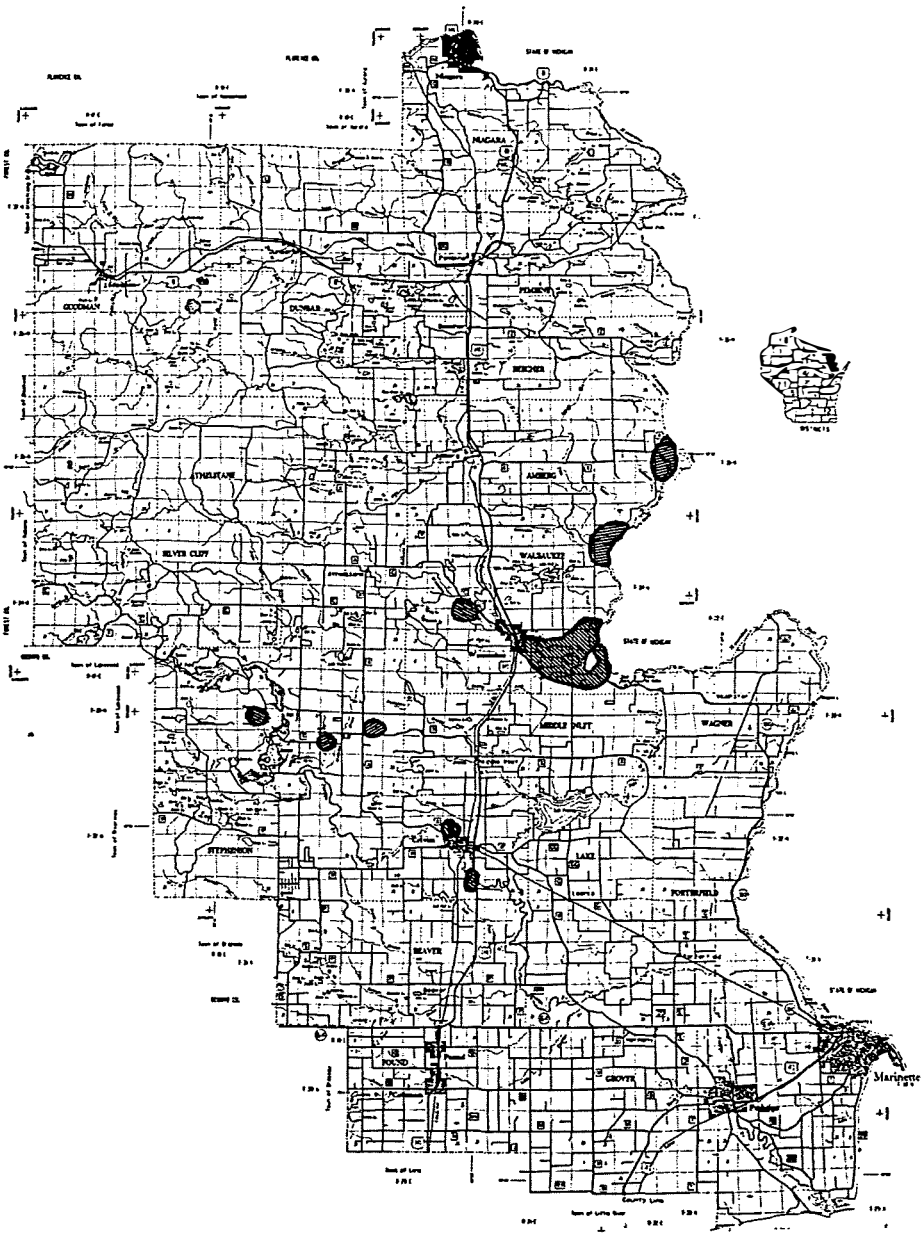

Figure 9. Area of Marinette County with oak wilt-1993.

Two-lined Chestnut Borer - *Agrilus bilineatus* (Weber)

Oaks stressed during the recent outbreak of forest tent caterpillar in Marinette County continue to die as a result of this secondary pest. The rate of mortality, however, appears to be decreasing as defoliation stress declines with the continuing collapse of the forest tent caterpillar population.

Redhumped Oakworm - *Symmerista canicosta* Franclemont

Spotty heavy defoliation occurred on northern pin oak in southeastern Menominee County. This is the first year of the outbreak.

Post Oak Locust - *Dendrotettix quercus* Packard

Light populations were observed on bur, white and red oak in Eau Claire and Jackson counties.

PINE

Common Pine Shoot Beetle - *Tomicus piniperda* (L.)

A survey of over 200 Christmas tree plantations and nurseries in 24 counties revealed no shoot beetles or damage according to a report by Wisconsin Department of Agriculture, Trade & Consumer Protection.

Diplodia Canker and Shoot Blight - *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

Diplodia shoot blight was identified in a red pine plantation in Jackson County (T21N, R3W), where terminal leaders and lateral branches were affected (trees approximately 5.5 feet tall). The red pine were also infested with white pine weevil and jack pine budworm.

Diplodia was also observed in a 52-year-old red pine plantation in Wood County (T21N, R6E, Section 32, N½, NE¼). Two salvage harvests have been conducted in recent years in this stand. An adjoining stand of 15-year-old red pine has scattered branch cankers in the crowns. Soils, ground flora and past fertilization activities are being evaluated to determine what other factors may be contributing to mortality.

Severe crown dieback occurred in a 15- and a 32-year-old red pine plantation in Armenia township of Juneau County. Contributing causes are hail damage in 1991, Diplodia infections, high water table in 1993 and needle burning caused by drifting vine desiccant from an adjoining potato field.

Red Pine Shoot Blight - *Sirococcus conigenus*

No new counties reported this disease yet two new infection sites were observed in northwestern Wisconsin (Figure 10). A moderate to heavy pocket occurred in Solon Springs township, (T45N, R11W, Section 25, SE¼), Douglas County. A heavy to severe infection center appeared in Barnes township, (T46N, R9W, Section 27, SW¼, SW¼) Bayfield County. Both stands are about 10 to 12 years old.

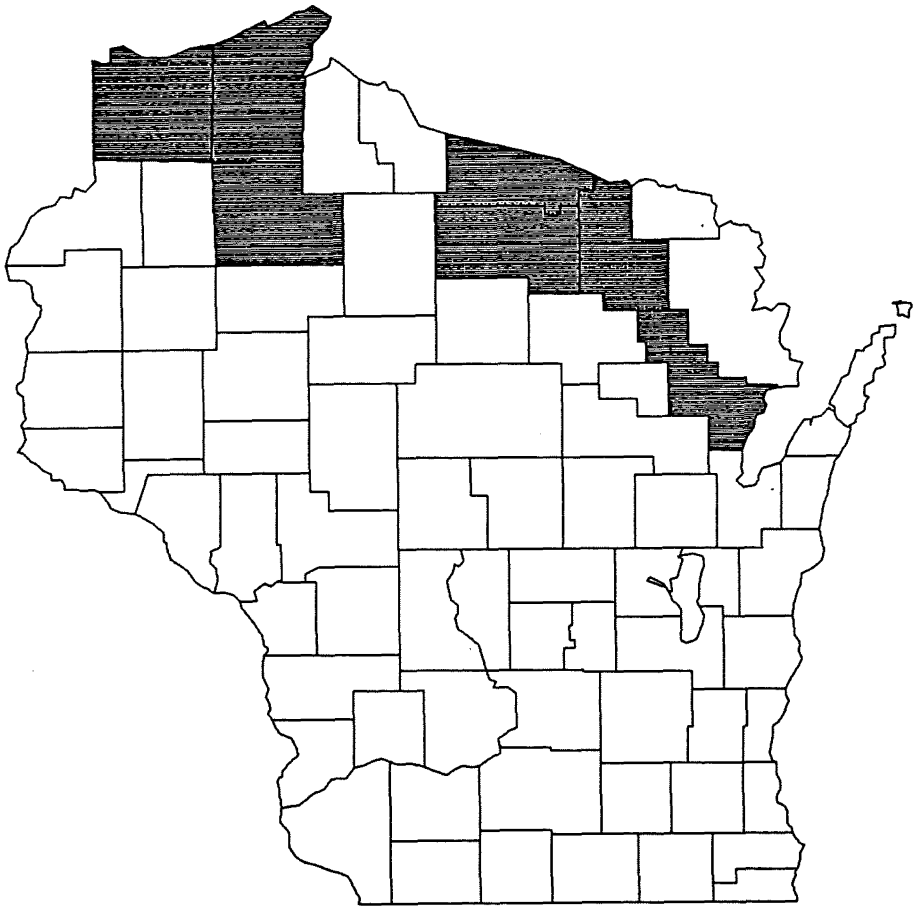

Figure 10. Known distribution of red pine shoot blight-1993.

White Pine Blister Rust - *Cronartium ribicola*

Signs of rust (uredospores) were observed on Ribes foliage in the southern part of the state during the week of May 17.

Pine Tussock Moth - *Dasychira pinicola* (Dyar)

This summer defoliator of jack pine is in the second year of outbreak populations in the northwestern counties. It defoliated 6,600 acres of pole and sapling jack pine in Douglas County (Figure 11); there were 4,000 acres of near total defoliation with extensive tree mortality.

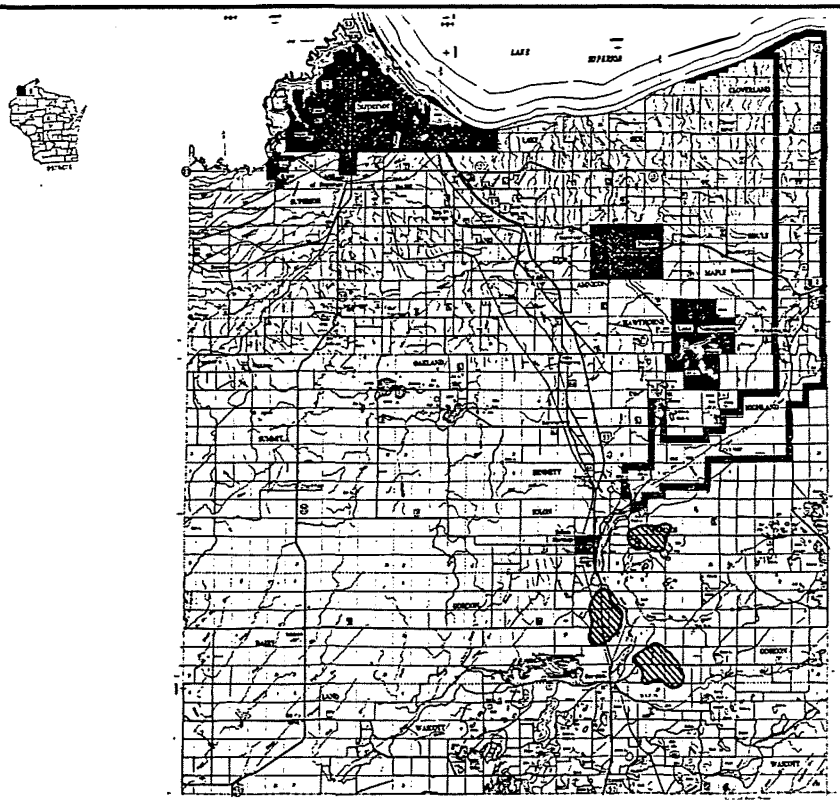

Figure 11. Area of defoliation of jack pine by the pine tussock moth-1993.

The 1992 outbreak in Burnett County collapsed due to infection of overwintering larvae by the fungus *Beauvaria bassiana*.

Egg mass surveys in Douglas County indicate a potential for severe defoliation on approximately 20,000 acres in 1994.

Jack Pine Budworm - *Choristoneura pinus* (Rohwer)

This defoliator erupted in northern and central Wisconsin to cause moderate to heavy defoliation on 400,000 acres of jack pine (Figures 12-26). This was the second year of defoliation in Clark, Eau Claire and Jackson counties, and first year defoliation in Monroe County.

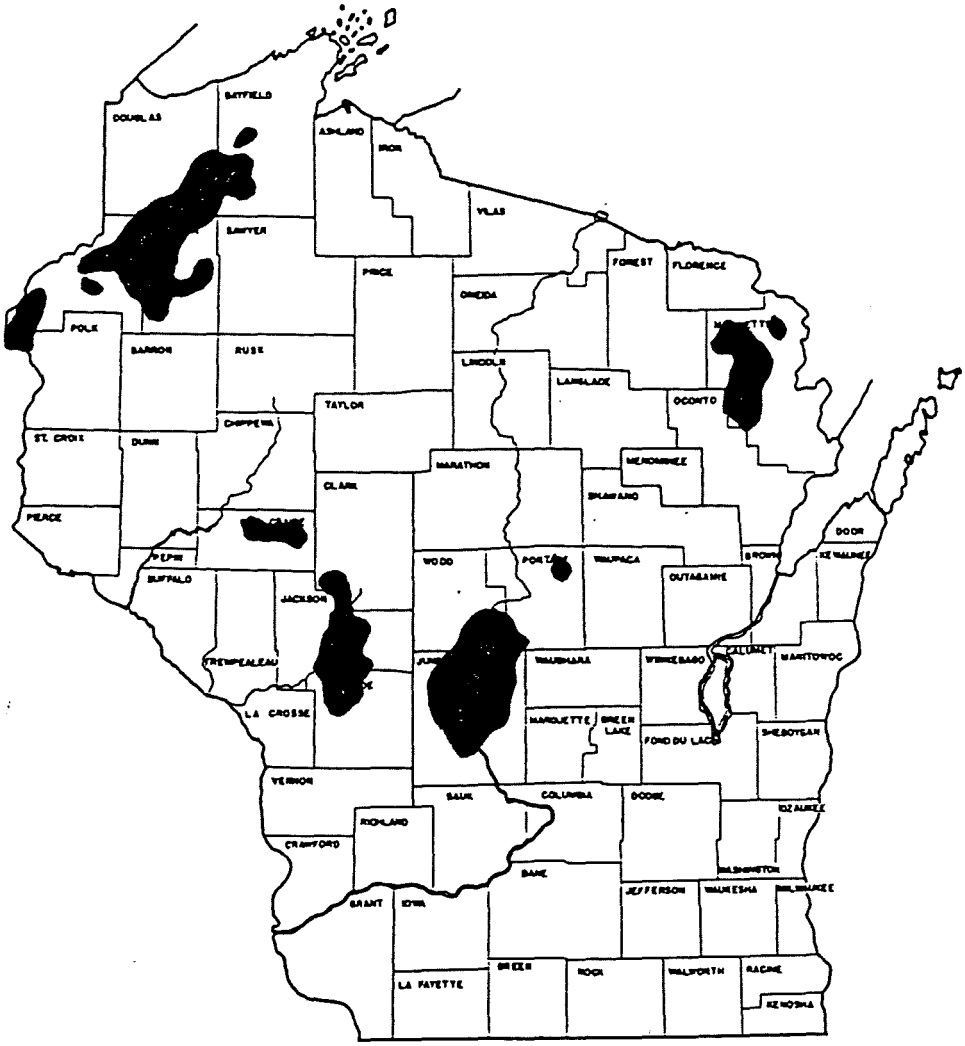

Figure 12. Area of defoliation by the jack pine budworm-1993.

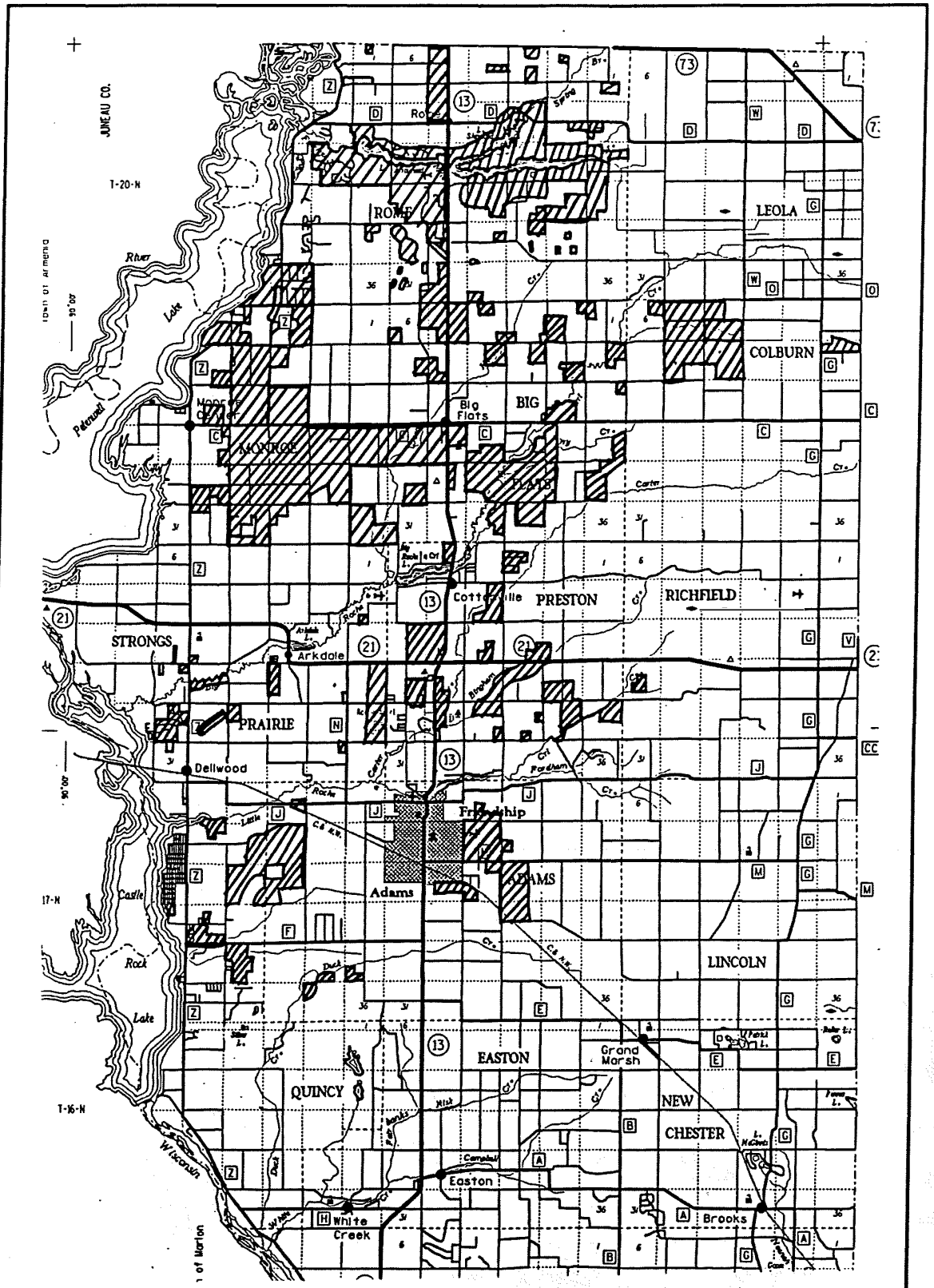

Figure 13. Area of defoliation by the jack pine budworm in Adams County-1993.

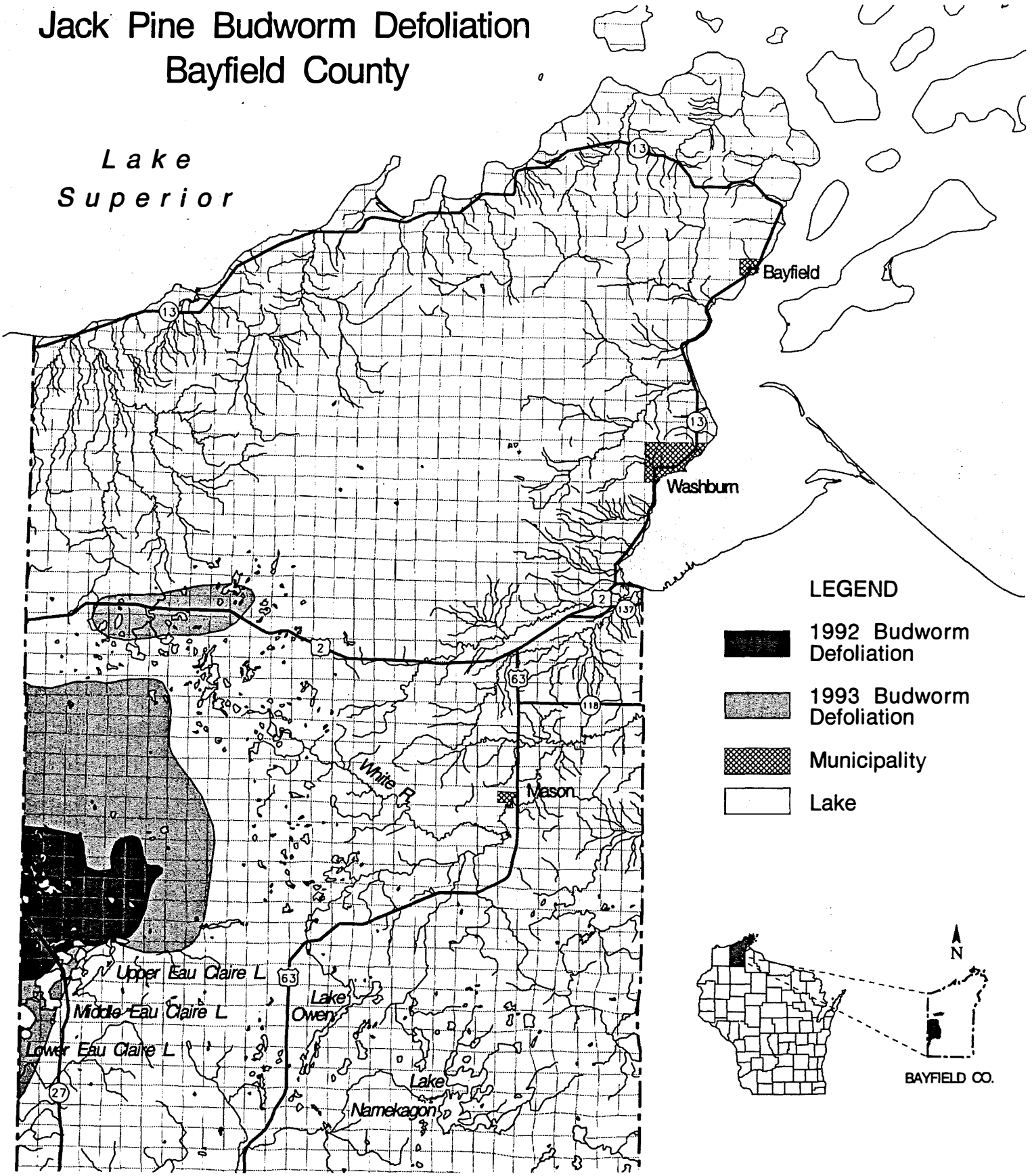

Figure 14. Area of defoliation by the jack pine budworm in Bayfield County-1993.

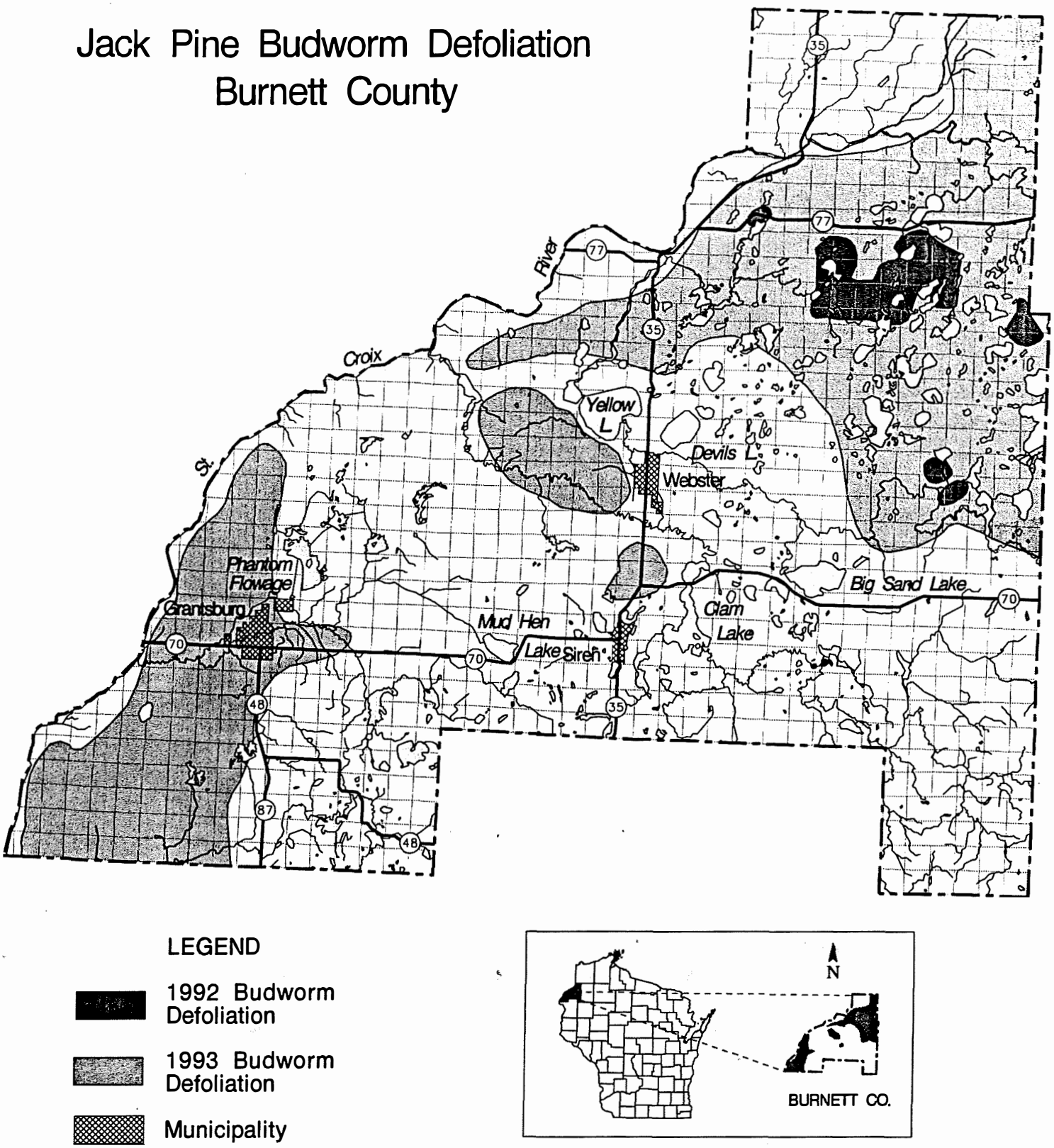

Figure 15. Area of defoliation by the jack pine budworm in Burnett County-1993.

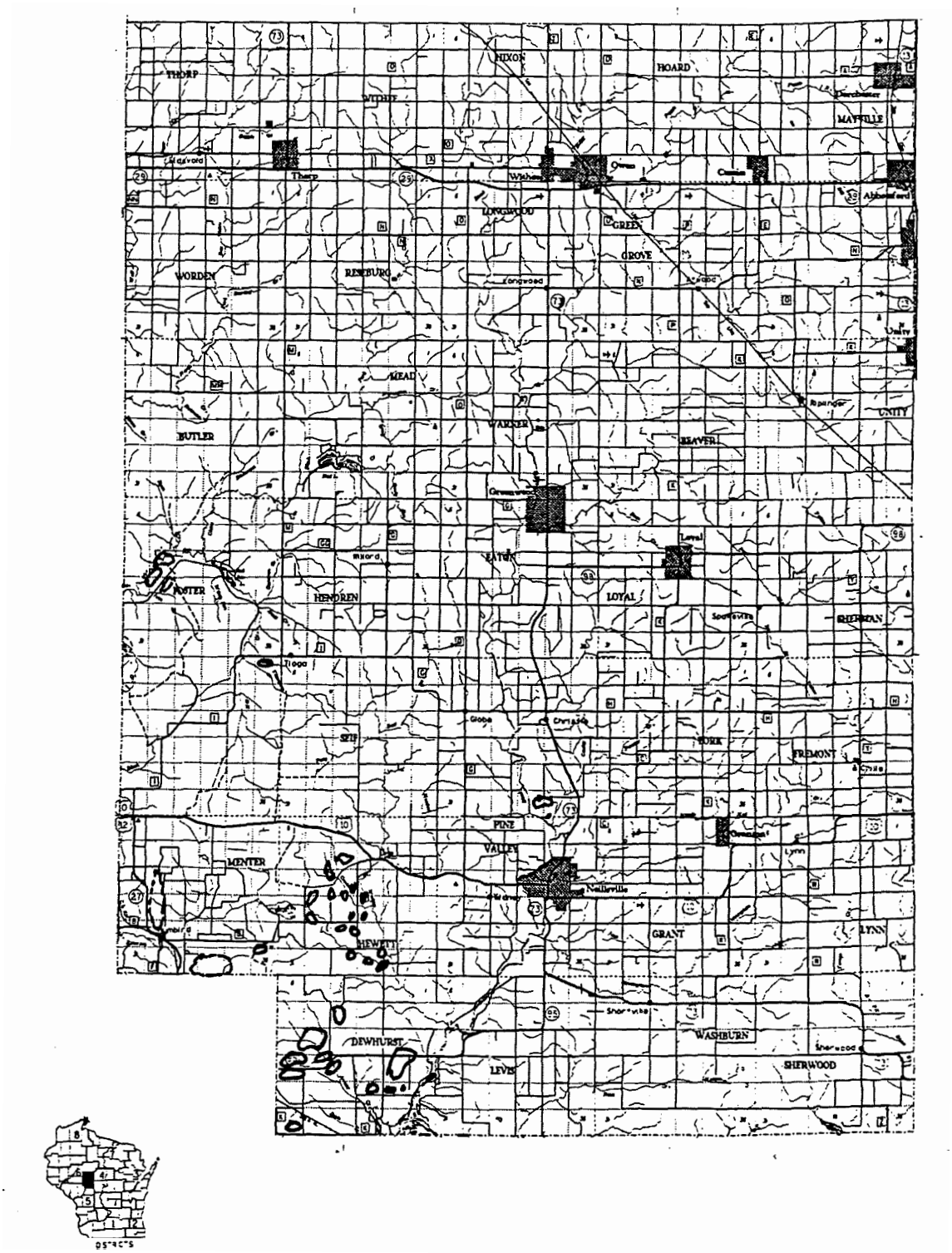

Figure 16. Area of defoliation by the jack pine budworm in Clark County-1993.

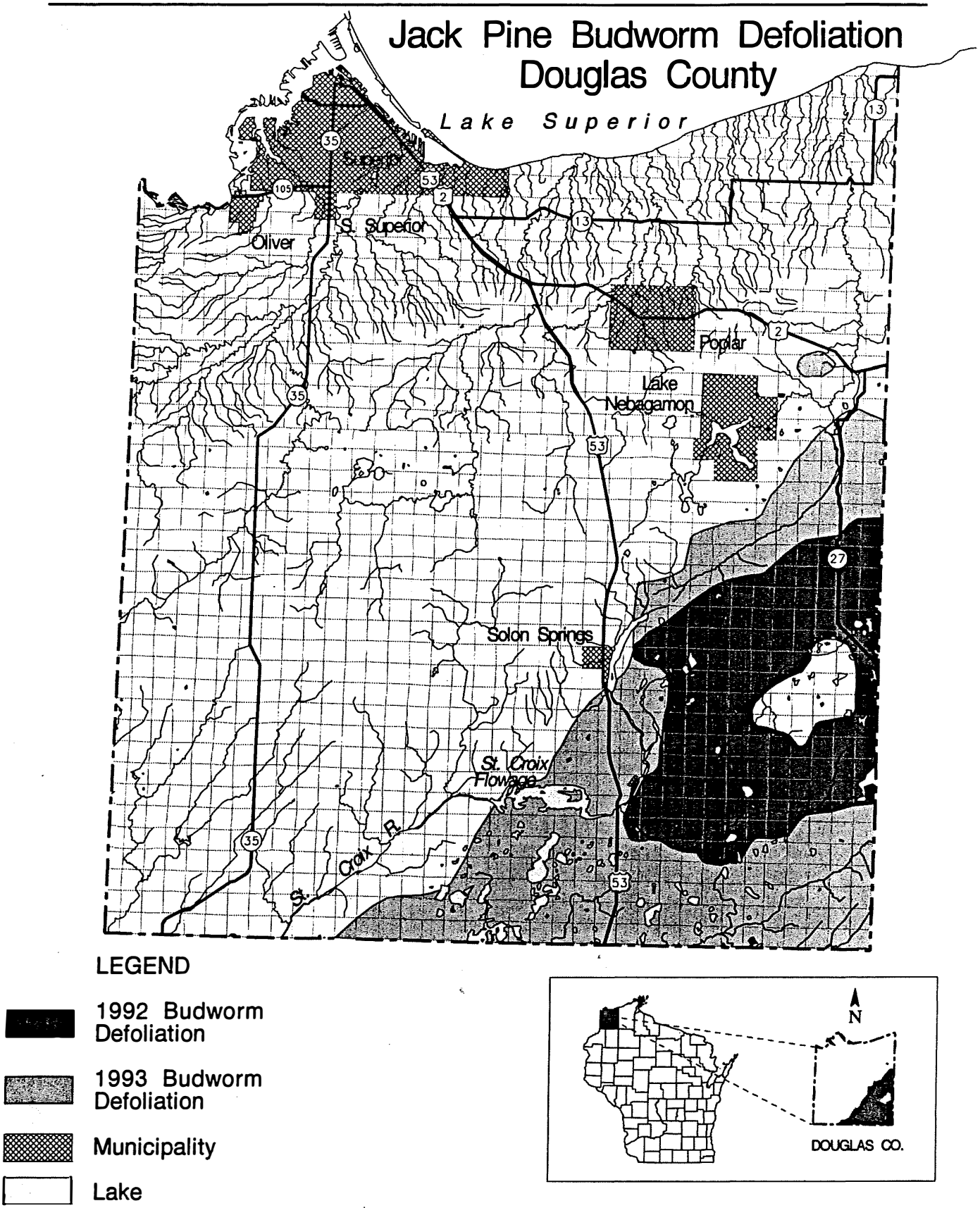

Figure 17. Area of defoliation by the jack pine budworm in Douglas County-1993.

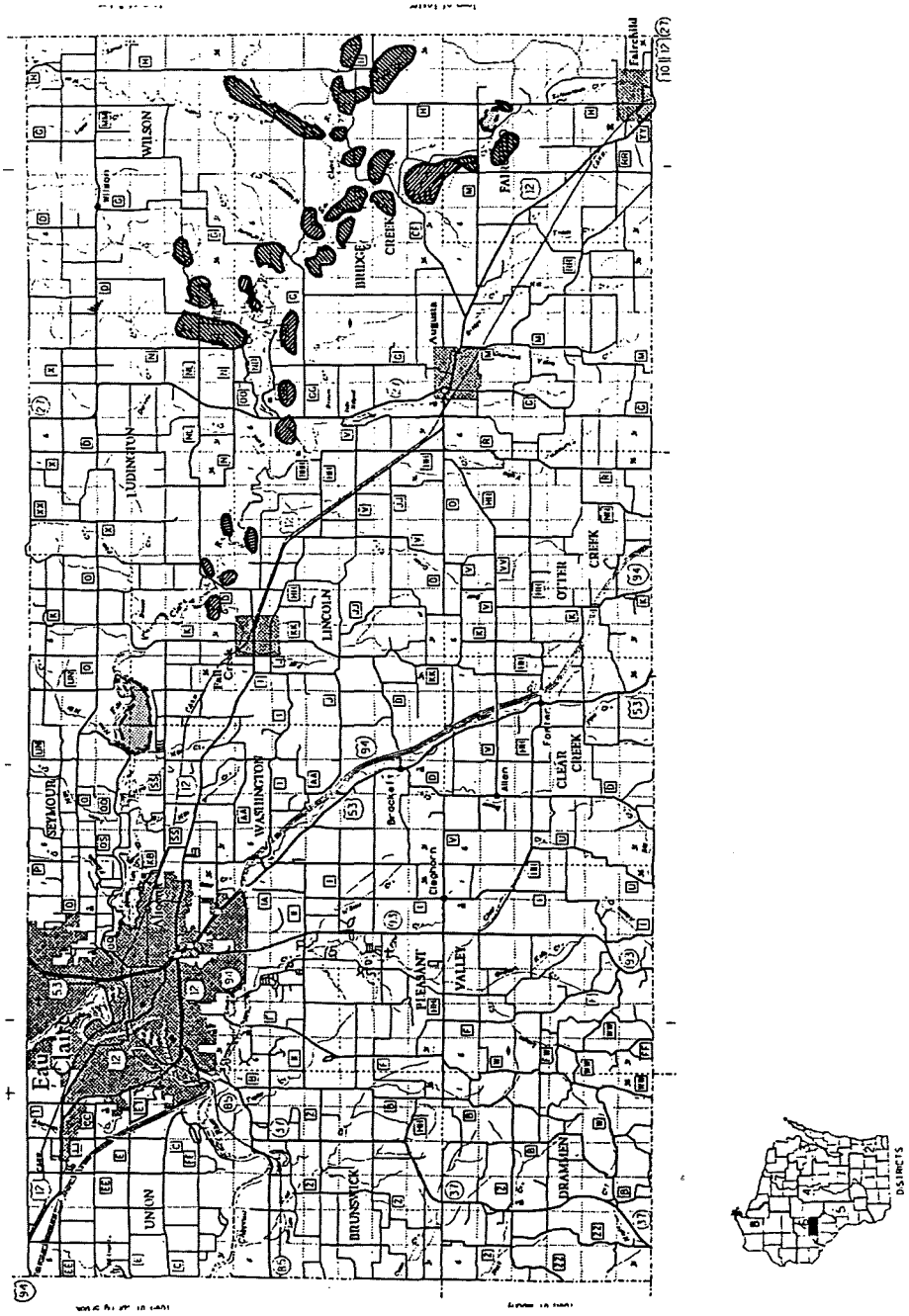

Figure 18. Area of defoliation by the jack pine budworm in Eau Claire County-1993.

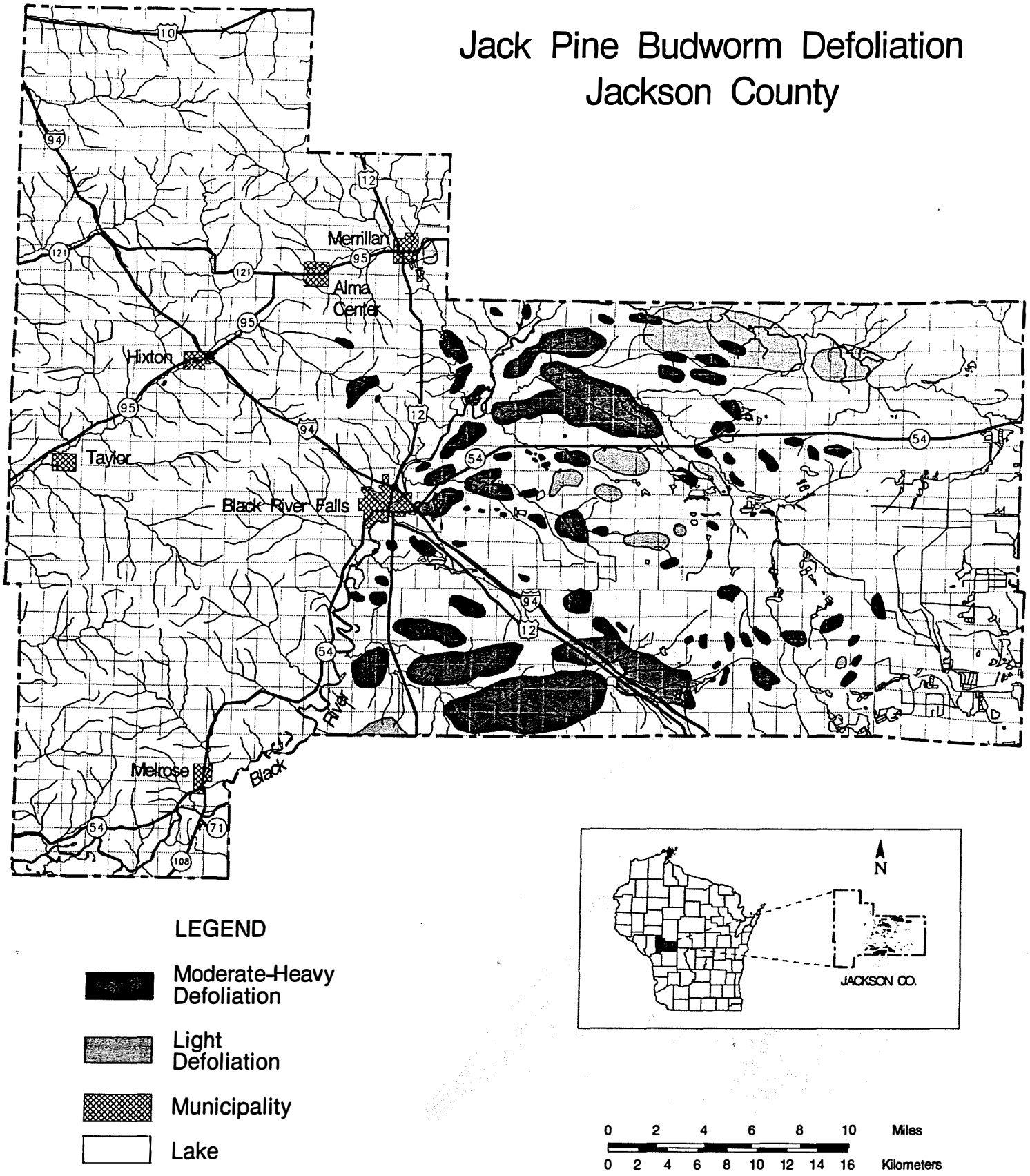

Figure 19. Area of defoliation by the jack pine budworm in Jackson County-1993.

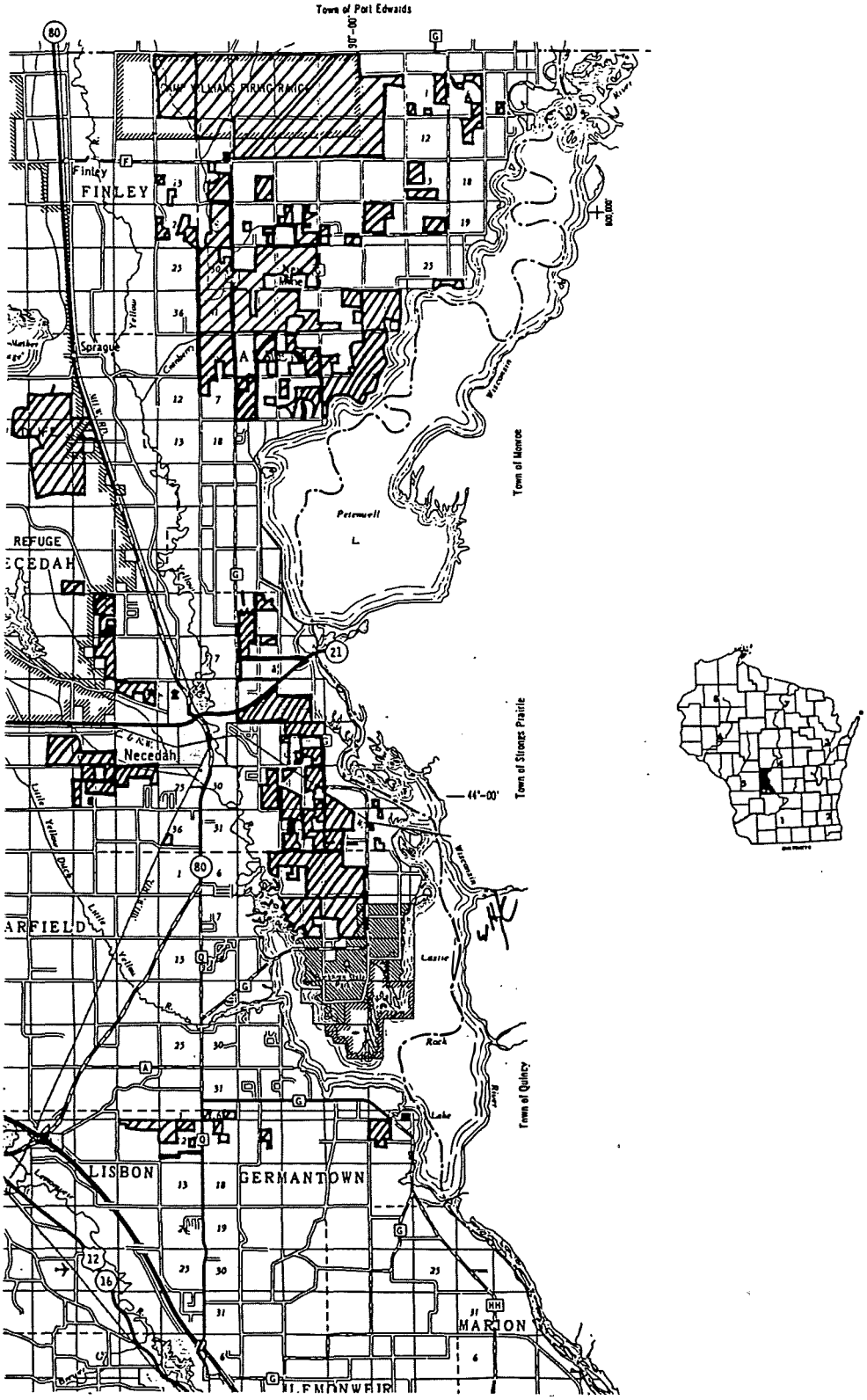

Figure 20. Area of defoliation by the jack pine budworm in Juneau County-1993.

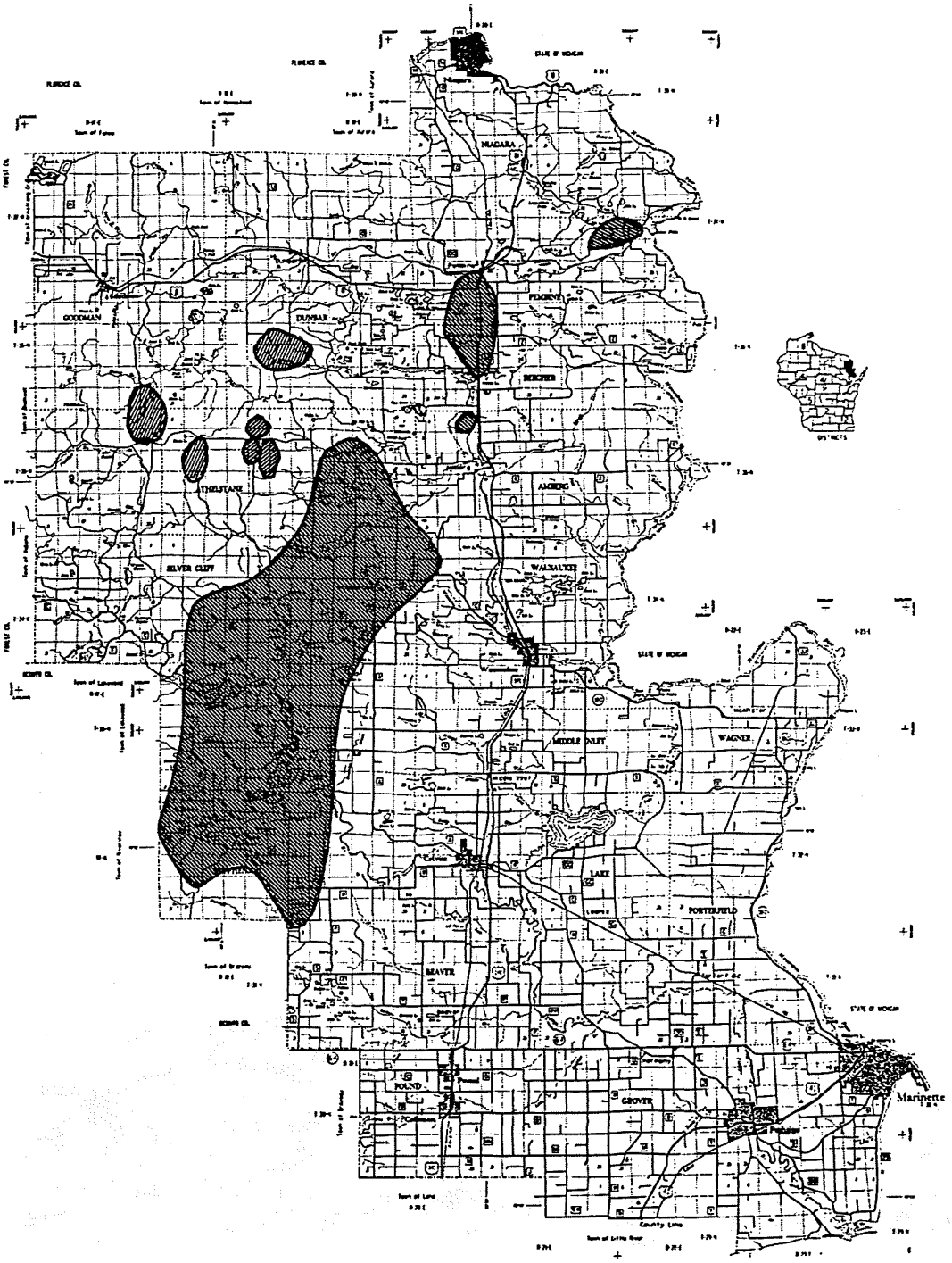

Figure 21. Area of defoliation by the jack pine budworm in Marinette County-1993.

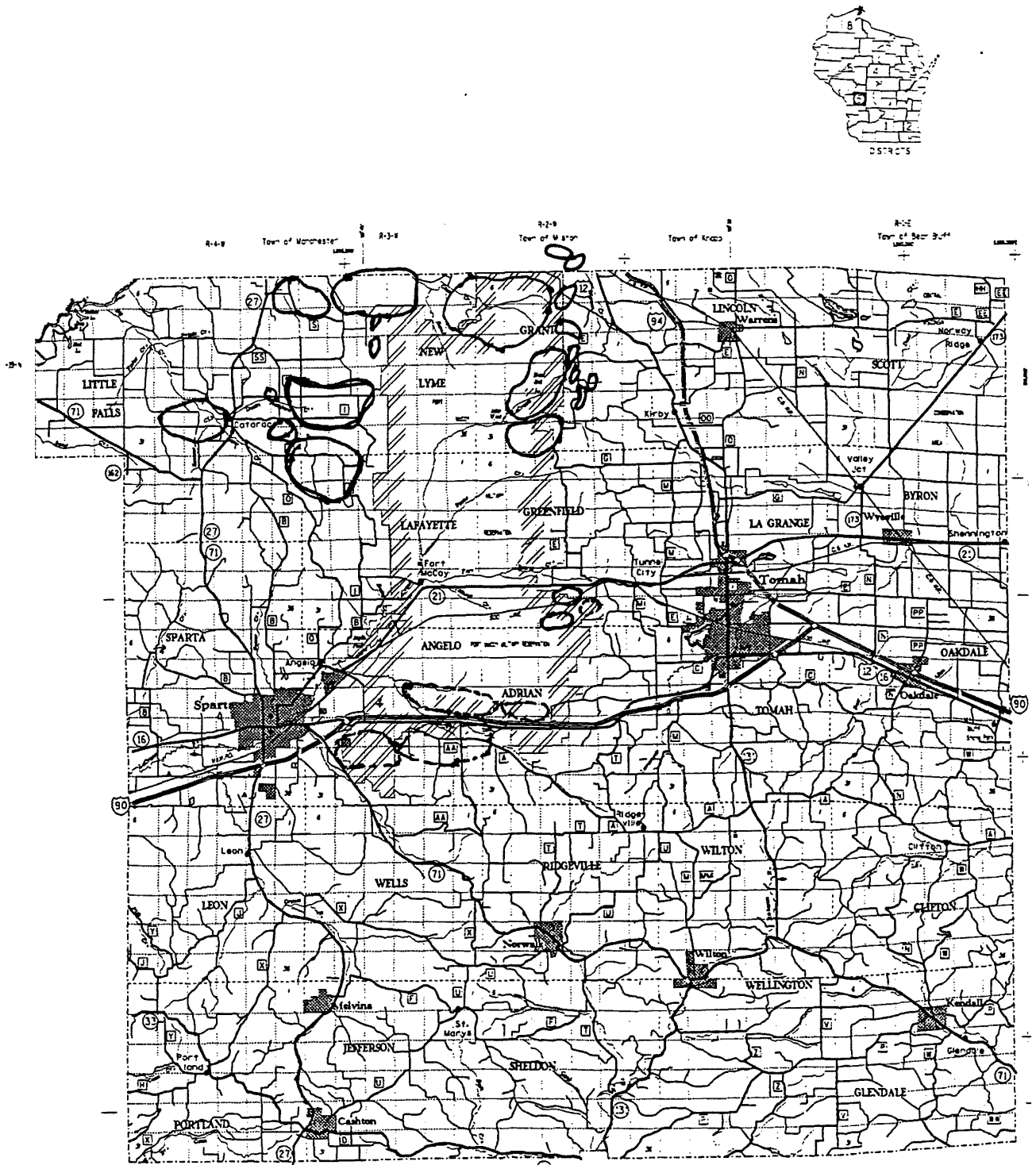

Figure 22. Area of defoliation by the jack pine budworm in Monroe County-1993.

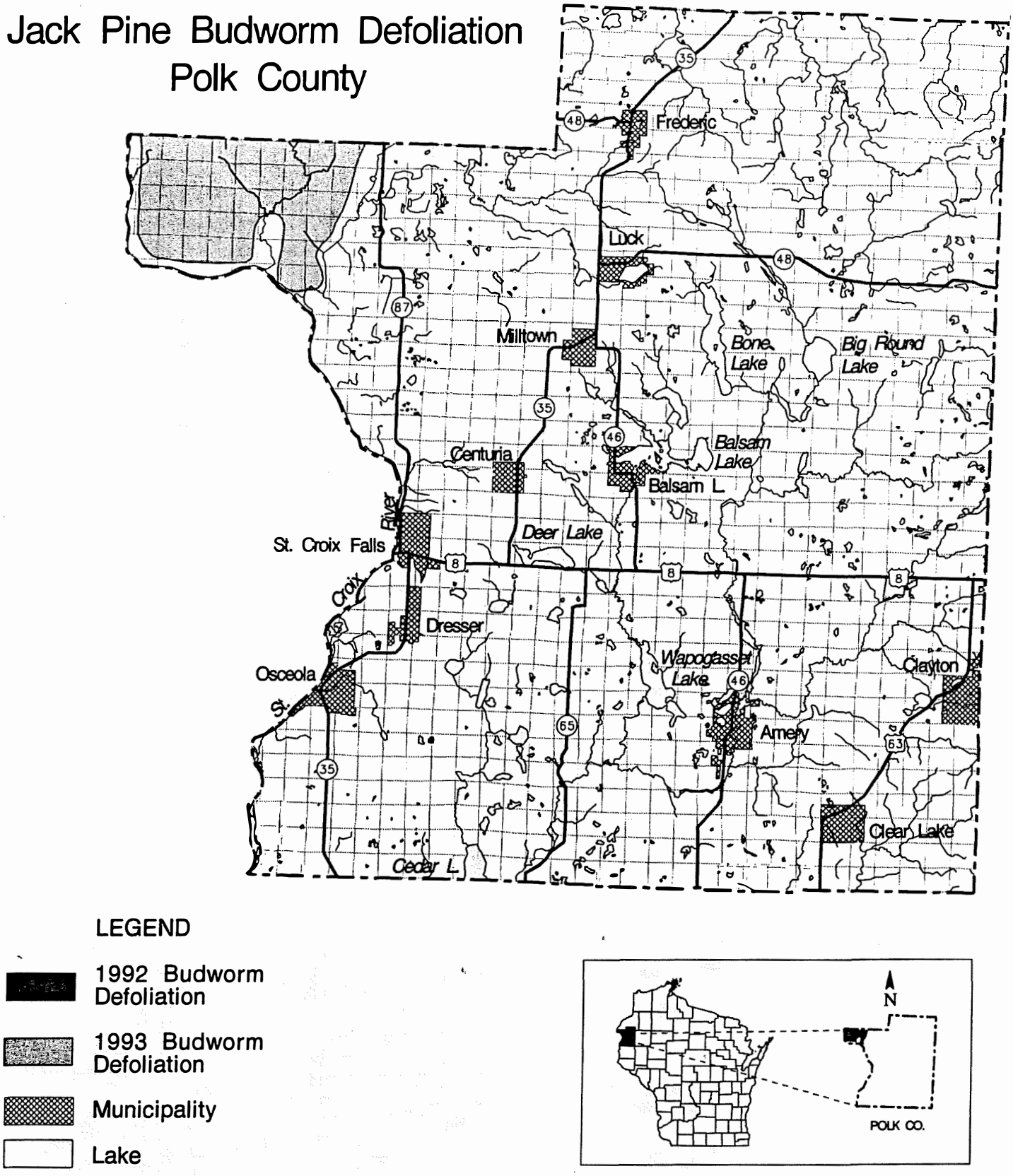

Figure 23. Area of defoliation by the jack pine budworm in Polk County-1993.

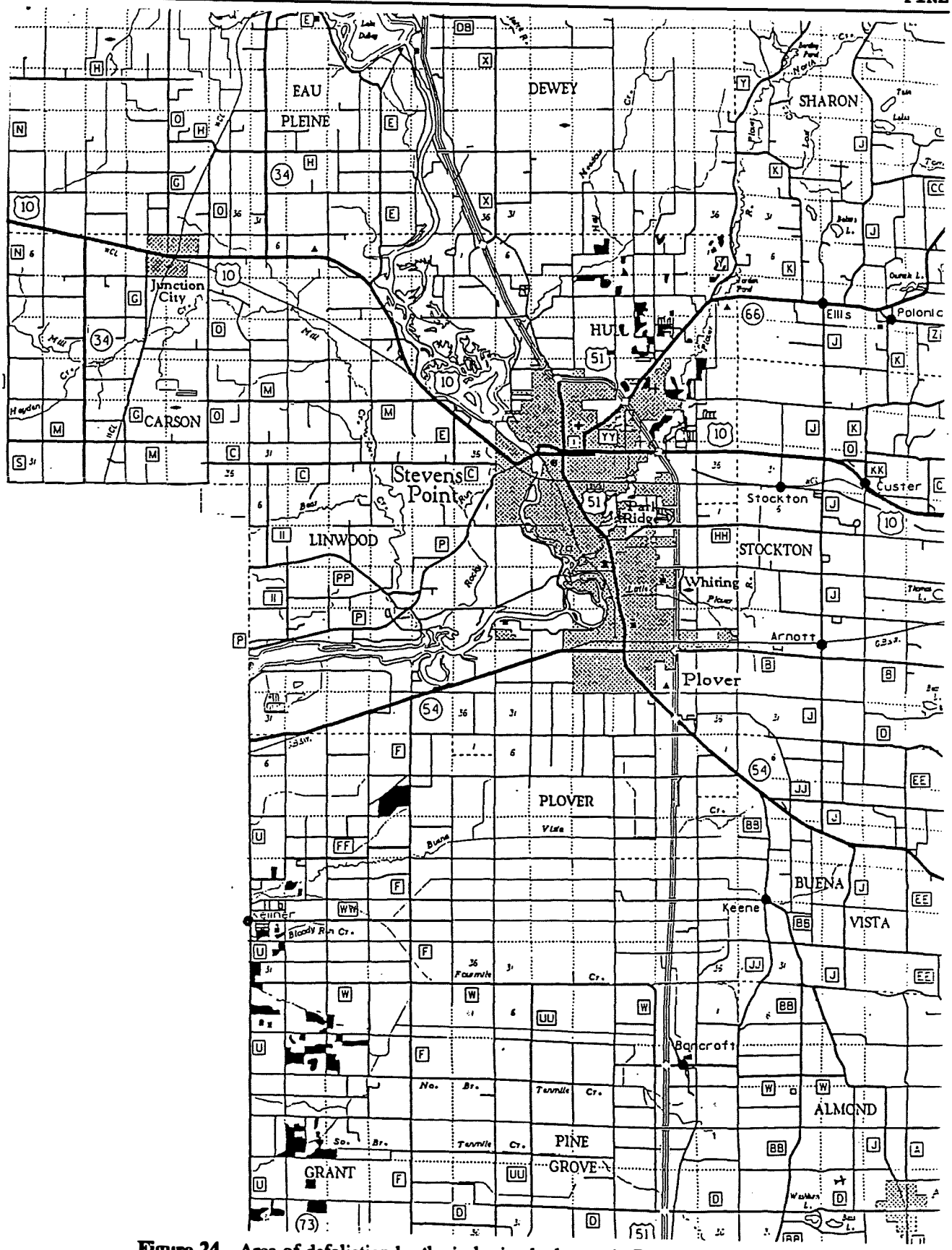

Figure 24. Area of defoliation by the jack pine budworm in Portage County-1993.

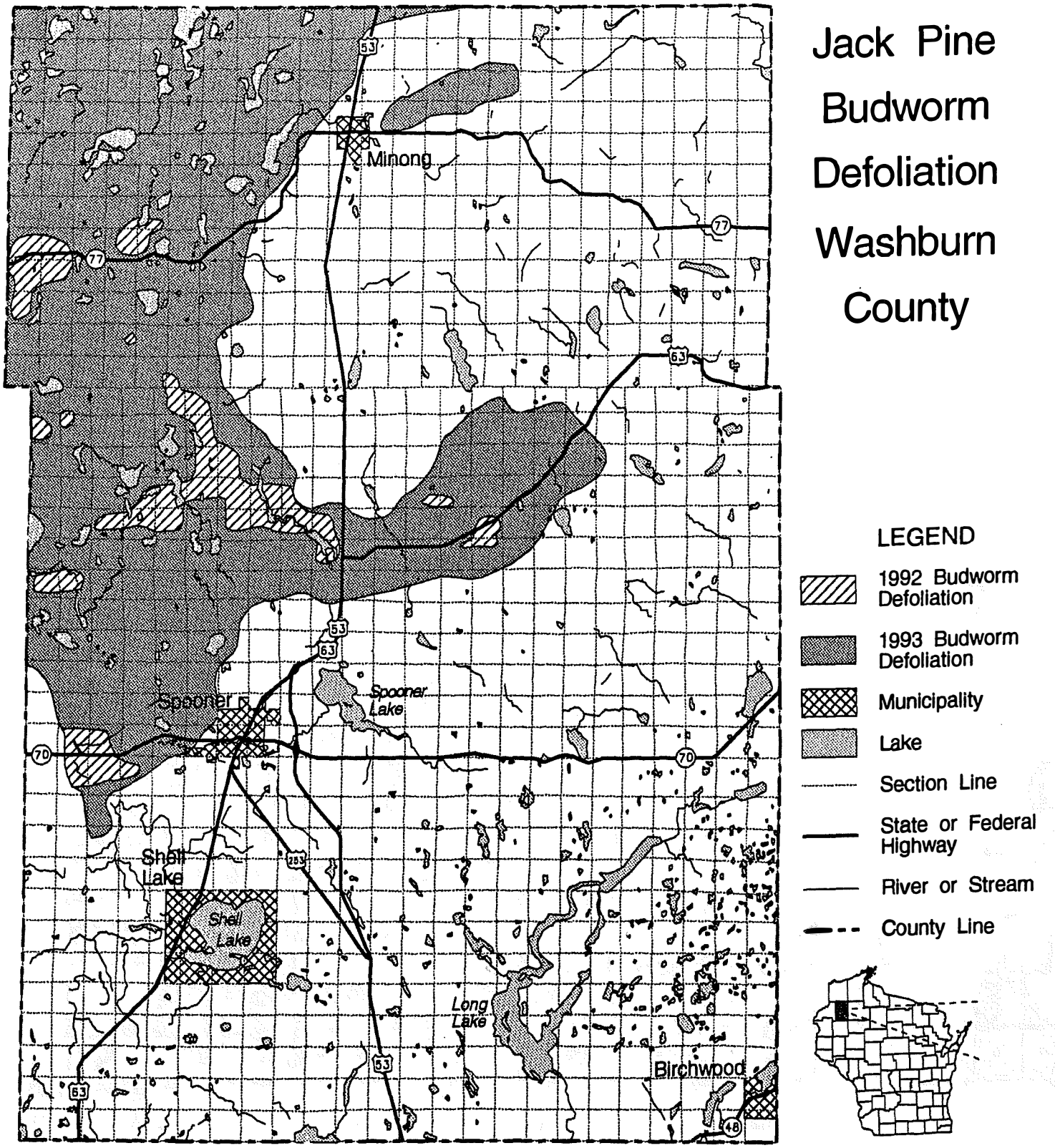

Figure 25. Area of defoliation by the jack pine budworm in Washburn County-1993.

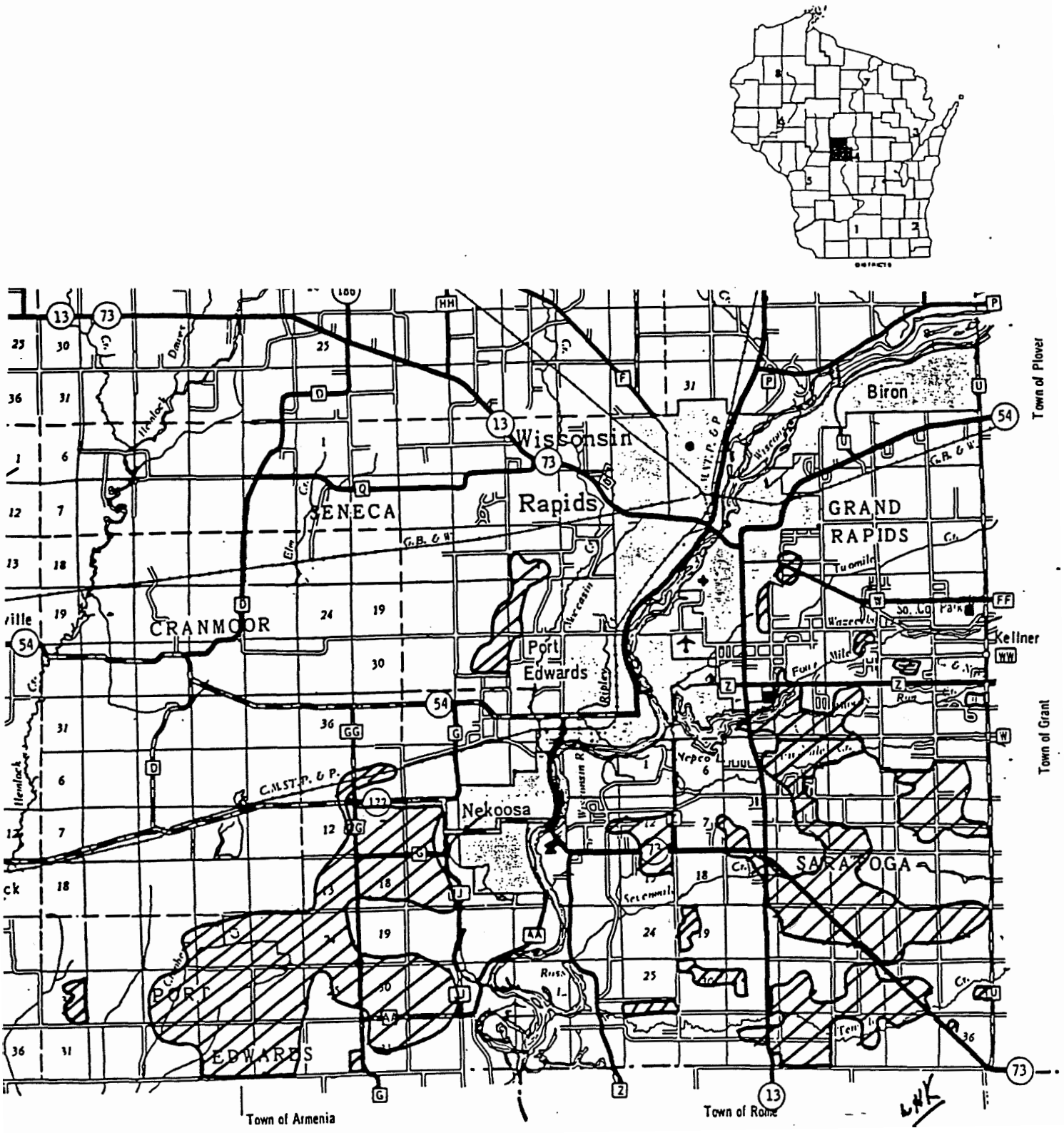

Figure 26. Area of defoliation by the jack pine budworm in Wood County-1993.

The largest areas of defoliation were in the northwest where periodic outbreaks are expected. Heavy defoliation occurred in Adams, Juneau, Wood, Clark, Eau Claire, Jackson and Monroe counties. Light feeding was apparent in the Conover area of Vilas county. In Oconto county a 90-acre planting of sapling white pine suffered heavy terminal and upper lateral defoliation. Spotty light to moderate defoliation occurred in Oconto and Marinette counties in the northeast. Defoliation in Marinette county was heaviest in overmature natural stands of jack pine stands in Silver Cliff Township (Sections 22, 23, 27, 26, 34, 35, T34N, R18E).

In Juneau and Wood counties, tree mortality is expected to be high because many trees lost 90 to 100 percent of their foliage.

Number of acres of jack pine defoliated by the jack pine budworm - 1993.

COUNTY	NO. ACRES
Adams	36,155
Bayfield	38,000
Burnett	42,000
Clark	6,280
Douglas	97,500
Eau Claire	10,100
Jackson	72,060
Juneau	26,640
Marinette	16,000
Monroe	25,740
Polk	13,000
Portage	2,385
Washburn	36,000
Wood	9,203
TOTAL	416,663

Salvage harvests were scheduled in the defoliated stands that were predicted to suffer heavy mortality. Some of the harvests in the central and west-central counties were in potential conflict with the protection of the Karner Blue Butterfly, a newly listed endangered species. Guidelines were developed to survey for the Karner Blue and for its food plant, blue lupine. The guidelines also contain procedures to prevent damage to known Karner Blue habitat during harvest operations. Many defoliated stands that were scheduled for salvage harvests were surveyed.

Late season egg mass surveys revealed a 33% decline from 1992 levels in the northwestern counties portending a decrease in populations and defoliation in 1994.

In western and central Wisconsin, the egg mass surveys indicate the budworm populations should remain high in 1994. Egg mass surveys in Wood County averaged 5.8 egg masses per plot. Egg mass surveys in Marinette county indicate defoliation will likely be spotty and variable in intensity again in 1994.

White pine aphid *Cinara strobi* (Fitch), a bark-feeding aphid, was observed in western Wisconsin in Eau Claire, Jackson and Monroe counties, feeding on understory jack and white pine in areas infested with jack pine budworm. Pine

spittlebug, *Aphrophora parallela* (Say), was observed feeding on understory and overstory jack and white pine in western Wisconsin in Eau Claire, Jackson and Monroe counties in areas infested with jack pine budworm.

Phenological Notes:

June 30: Larvae in 4th and 5th instars in Eau Claire, Clark, Jackson and Monroe counties. Population 50% pupated near Millston in Jackson county.

July 7: All are in pupal stage in Jackson, Wood, Adams and Juneau counties.

July 14: Moths flying but no eggs have been deposited in Adams, Juneau and Wood counties.

July 30: Adults are flying and laying eggs in (LMD) counties.

European Pine Sawfly - *Neodiprion sertifer* (Geoffroy)

Defoliation was generally light and scattered in southern Wisconsin. Occasional trees were heavily defoliated. Heavy defoliation of red pine in Waushara County and on Scotch pine in Milwaukee County.

Phenological Note:

May 5: Larvae were hatching in Dane County.

Red Pine Sawfly - *Neodiprion nanulus nanulus* Schedl

Populations were very low in the south-central counties where this spring defoliator is normally found. Light feeding was observed in one pole sized red pine plantation in Columbia County.

Heavy defoliation of jack pine was reported in Solon Springs Township of Douglas County just a tad south of the Poodle Inn.

Jack Pine Sawfly - *Neodiprion pratti banksianae* Rohwer

Widespread light defoliation occurred on all ages of jack pine in Washburn Burnett, Douglas, Bayfield and Polk counties.

Introduced Pine Sawfly - *Diprion similis* (Hartig)

Populations declined to endemic levels in the northwest and western counties. Light populations defoliated pole sized and understory sapling jack pine in Eau Claire County.

Eastern Pine Shoot Borer - *Eucosma gloriola* Heinrich

Moderate populations damage sapling jack pine leaders in the northwestern counties.

Saratoga Spittlebug - *Aphrophora saratogensis* (Fitch)

New pockets of moderate to severe damage appeared in red pine sapling and pole sized plantations in northwestern Wisconsin. Two small areas, one with moderate damage, one with heavy damage, appeared in Trego township of Washburn County. A large pocket of moderate damage appeared in Wascott township of Douglas County. A large pocket of severe damage appeared in a plantation in Price County.

Pine Spittlebug - *Aphrophora cribrata* (Walker)

Populations of this sap sucking insect were higher than in recent years. Exceptionally heavy populations were observed in Douglas County. Populations were noted on jack and white pine in Eau Claire, Jackson and Monroe counties in areas infested with jack pine budworm and in Door County. Adult spittlebugs were observed in large numbers on budworm-damaged jack pine in Marinette County.

White Pine Aphid - *Cinara strobi* (Fitch)

Populations of this twig feeding aphid, was observed in western Wisconsin in Eau Claire, Jackson and Monroe counties, feeding on understory jack and white pine at moderate levels in areas infested with jack pine budworm.

White Pine Weevil - *Pissodes strobi* (Peck)

Terminal leaders were attacked and killed in a 5.5 feet tall red pine plantation in Jackson County (T21N, R3W). The plantation was also infested with jack pine budworm and Diplodia shoot blight.

Pine Engraver - *Ips pini* (Say)

Populations were very light generally due to the cool, wet summer season. Storm-damaged red pine pole timber in Marquette County provided breeding material for a light population.

Meadow Vole - *Microtus pennsylvanicus*

Several Lincoln County red pine plantations from 1 to 3 years since planting were severely damaged by voles feeding on the bark during the winter. An average of 400 trees per acre were girdled. Nearby cherry, willow and aspen sprouts were also damaged.

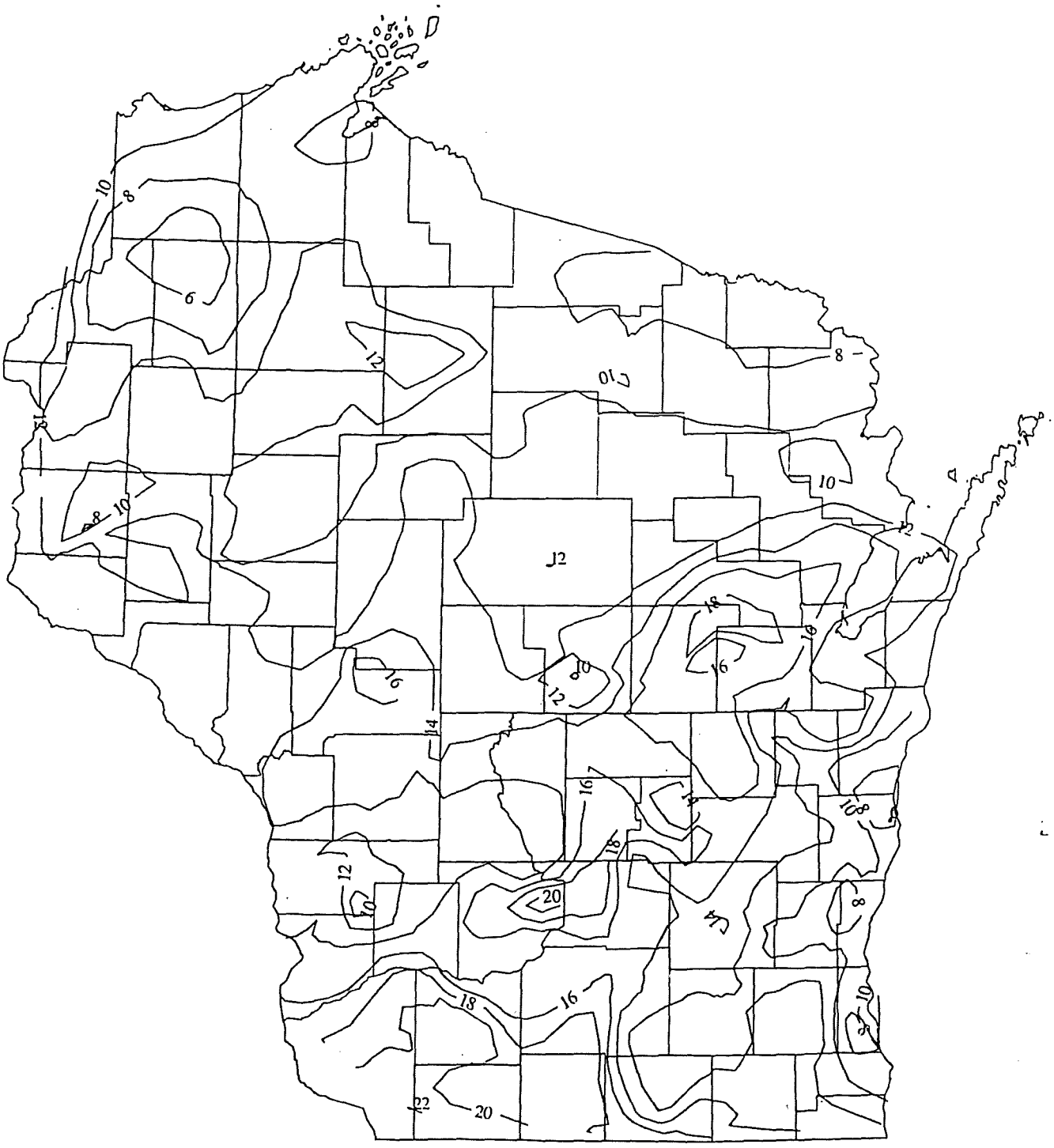

Figure 27. Aggregate rainfall (inches) June and July, 1993. Reprinted from "The Floods of 1993," WI DNR, 12/93, Bureau of Water Regulation and Zoning, compiled from 199 National Weather Service Reporting Stations.

Flooding - Heavy rain from May to July (Figure 27) caused flooding of many stands of red and jack pine in central Wisconsin. Many trees were killed during the summer; others were very yellow and will probably die. In some areas the plantations were still under six inches of water in December.

In Juneau County, a 20-acre sapling red and jack pine plantation was under 6 inches of water from May through August. Many trees were yellow, and many were dead by October.

In Adams County, several scattered natural jack pine stands and red pine plantations were under water for two months. Mortality was heavy east of Highway 13 and south of Rome to Big Flats; the pine engraver was present in the dead trees.

SPRUCE

Yellowheaded Spruce Sawfly: *Pikonema alaskensis* (Rohwer)

Spotty, moderate to heavy defoliation of sapling white spruce occurred in Douglas County.

YEW

American Yew - Mortality from a complex of factors

Widespread dieback and mortality of American Yew, *Taxus canadensis*, was observed in White Fish Dunes State Park, northeastern Wisconsin. The factors most likely playing a role in the mortality are the following:

1) Drought - In 1988 and '89, Wisconsin experienced a widespread drought. The weather station at Sturgeon Bay reported 3.24" and 5.85" of rain below normal for 1988 and 1989 respectively.

2) Possible freeze injury to the roots - During the winter of 1990-'91, there was very little snow cover and record frost depths were recorded in Wisconsin. some tree nursery crops in Wisconsin were injured by the very cold soil temperatures.

3) Freeze injury to the stems - On June 20 and 21, 1992, the air temperature dropped to 25°F in many locations throughout Wisconsin. Freeze injury was widespread to many species of conifers. Most of the yews in the park have small (1cm) longitudinal splits in the bark. Approximately 100 of these bark splits have been dated and occurred sometime during the '92 growing season. These bark splits were probably caused by the cold air temperatures in June, '92.

4) Deer browse injury - The yews are struggling to keep new growth as the deer eat the tender young shoots.

APPENDIX A

Diplodia Collar Rot - *Sphaeropsis sapinea*

Isolation and Identification of *Spaeropsis* Types A and B from Red Pine Seedlings in Wisconsin State Forest Tree Nurseries

INTRODUCTION

In 1992, mortality of new red pine plantings was observed in Barron, Dunn, St. Croix, and Eau Claire counties. Factors such as the dry plantin season, the herbicide Oust, and the presence of Diplodia collar rot caused by *Sphaeropsis sapinea* have all been suggested as contributing to mortality. Diplodia collar rot is relatively easy to diagnose on dead seedlings because of the abundance of pycnidia, or fungal fruiting bodies of *Sphaeropsis* at the root collar. Methods for diagnosing this disease have not been developed for live seedlings, yet dead seedlings with Diplodia collar rot often have a small lateral shoot in the root collar region (basal shoots) that supports abundant pycnidia. The presence of dead and dying basal shoots in the root collar region on live seedlings is currently the best sign we have that triggers further examination for collar rot. Inspections were made of seedlings selectively collected from each of the 3 DNR nurseries to help determine what symptoms and signs of Diplodia collar rot would be useful for future surveys. Laboratory techniques were refined, and the isolates of *Sphaeropsis* obtained from these seedlings were categorized as "A or B" type by Dr. Glen Stanosz and Mark Guthmiller. The Type A isolate is considered a more aggressive pathogen than the Type B isolate. The objectives of the inspections were to determine the following:

1) Can laboratory techniques such as microscopic examination of the root collar and lateral shoots in the root collar region aid in identification of Diplodia collar rot on living red pine?

2) Can isolations from the basal shoots or root collar region on living seedlings help detect Diplodia collar rot?

3) If *Sphaeropsis sapinea* is isolated from the red pine seedlings, what isolate types (A or B) are present?

MATERIALS AND METHODS

Approximately 100 red pine seedlings were collected from each of the 3 DNR state nurseries. Seedlings with dead and dying basal shoots in the root collar region were favored for collection in hopes of obtaining seedlings infected with *Sphaeropsis*. The basal shoots were examined for the presence of fruiting bodies. If fruiting bodies were present, they were transferred to water agar for identification. Isolations were made, either from basal shoots or the root collar region, from every seedling. The tissue was disinfected by soaking in 95 percent ethy alcohol for 30 seconds, following by soaking in 20 percent Chlorox for 2 minutes, and 20 percent Chlorox for 2 minutes again. The isolations were made on water agar and grown under artificial light for 3 months. Identification of *Sphaeropsis* in culture was conducted by Dr. Glen Stanosz and Mark Guthmiller.

RESULTS

The seedlings examined in the study were specially selected from each nursery from areas where *Sphaeropsis* was expected to be found. The data does not reflect the health status of the nursery stock in general.

All trees, with and without basal shoots, were examined for the presence of *Sphaeropsis* pycnidia and isolated onto water agar. No *Sphaeropsis* pycnidia were observed on any of the seedlings without basal shoots. Pycnidia were rarely observed (2 of 125) on live and more frequently observed (7 of 37) on dead shoots (Table 1).

Table 1. Number of live and dead basal shoots with *Sphaeropsis* pycnidia and number of trees with no basal shoots and with *Sphaeropsis* pycnidia.

Nursery	No. of Live Basal Shoots with *Spaeropsis* Pycnidia/ No. of Shoots Examined	No. Dead Basal Shoots with *Spaeropsis* Pycnidia/No. Shoots Examined	No. Trees with no Basal Shoots and with *Spaeropsis* Pycnidia/No. Trees Examined
Hayward	0/54	3/30	0/15
Wilson	0/15	0/0	0/3
Griffith	2/56	4/7	0/12
TOTAL	2/125	7/37	0/30

Isolations revealed the presence of *Sphaeropsis* on seedlings with live, dead, and no basal shoots (Table 2). Pycnidia were not observed on trees without basal shoots yet *Sphaeropsis* was isolated from 37 percent of these trees. Pycnidia were present on .1 and 19 percent of the live and dead tree shoots, respectively, and *Spaeropsis* was isolated from 12 and 19 percent of the live and dead basal shoots, respectively.

Table 2. Number of trees with live, dead and no basal shoots that *Sphaeropsis* was isolated from.

Nursery	No. of Trees with Live Basal Shoots that *Spaeropsis* Was Isolated From/No. Trees Isolated	No. Trees with Dead Basal Shoots That *Spaeropsis* Was Isolated From/No. Trees Isolated	No. Trees with no Basal Shoots that *Spaeropsis* Was Isolated From/No. Trees Isolated
Hayward	2/54	7/54	5/15
Wilson	2/15	0/0	0/3
Griffith	11/56	5/7	5/12
TOTAL	15/125	12/61	10/27

Each of the isolates of *Spaeropsis* from basal shoot tissue or root collar tissue were transferred onto Potato Dextrose Agar and incubated in the dark at 24°C. Identification of the A or B type sorted out as follows: Hayard - 13 of the 14 isolates were the A type (1 is still in question); Wilson - 1 of 2 isolates were the A type (1 is still in question); Griffith - 18 of 21 isolates were the A type (3 are still in question).

All of the 9 isolates (3 from Hayward, 6 from Griffith) obtained directly from pycnidia on the basal shoots were the A type.

CONCLUSIONS

The seedlings examined in the study were specially selected from each nursery from areas were *Spaeropsis* was expected to be found. The data does not reflect the health status of the nursery stock in general.

Spaeropsis was isolated from seedlings with and without pycnidia, with and without basal shoots, and with no symptoms or signs of disease. The presence of *Spaeropsis* on seedlings without basal shoots is especially interesting given the hypothesis that the basal shoots were providing a point of infection. The shoots could have been present when the seedlings were younger then rotted, yet it is not thought that this can be an explanation for every seedling. These basal shoots may still be an important part of the infection process but do not appear to be necessary for infection. The isolation results reveal the use of pycnidia alone as a survey tool is inadequate. Pycnidia can be used to key into further examination yet isolations must be conducted to get more of an accurate account for the presence of *Spaeropsis*.

The presence of A type isolate at all three nurseries is not surprising since this type has been associated with Diplodia shoot blight on red pine seedlings in Wisconsin. No other symptoms or signs were found that could aid in identificiation of Diplodia collar rot.

The significance of the presence of *Spaeropsis* on seedlings with no outward signs of disease is still unknown. Dr. Stanosz's work, currently underway at the University of Wisconsin, may shed some light on this. Historically, *Spaeropsis* has been associated with trees under stress. Therefore, minimizing stress on newly planted seedlings is an important part of minimizing the effects of this disease in the field.